SEPTEMBER 8, 1958

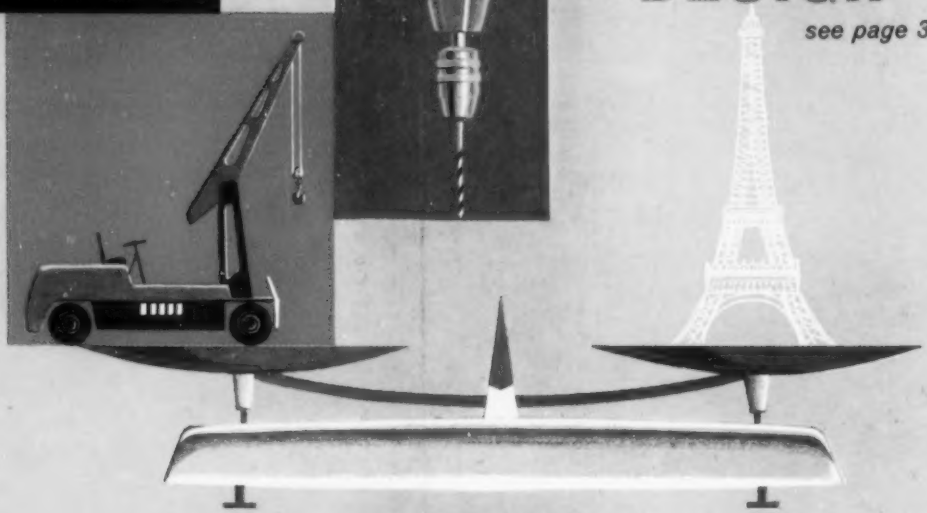
RESEARCH and DEVELOPMENT news edition

Product Engineering

McGRAW-HILL MAGAZINE OF DESIGN, RESEARCH AND DEVELOPMENT

FRENCH DESIGN

see page 34



RESEARCH MANAGEMENT

see page 30

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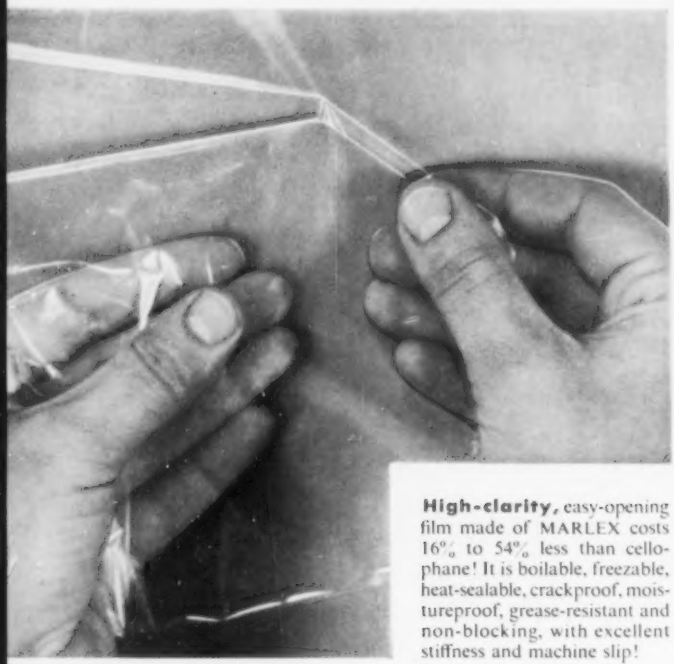

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the DESIGN issue

for September 15

FEATURING

- **Electroluminescence**
  New area-source of light will soon be glowing in many products.
- **Sintered nylon**
  Powder techniques turn out stronger, better wearing parts.
- **Immersed motors**
  They may be canned, potted, sealed with fluid or, now, completely open.
- **Debugging—last step in design**
  A precise, step-by-step approach keeps time and costs to a minimum
- **Magnetic-force welding**
  First published data on weld strengths and welding arrangements.
- **13 handy lever mechanisms**
  A review of levers and linkages for extra versatility.

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Product Engineering

McGRAW-HILL MAGAZINE OF DESIGN, RESEARCH AND DEVELOPMENT

R and D RESEARCH and DEVELOPMENT news edition

September 8, 1958 Vol. 29, No. 36

FEATURED:

ALUMINUM AUTO ENGINES—a series of clues indicates Chevrolet is making the switch 19

WOMEN ENGINEERS—this reservoir of untapped talent gets little encouragement from company recruiters 19

RESEARCH MANAGEMENT. First understand the man, then encourage him with what he values most 30

POINTS OF VIEW. Five company executives comment on paid leave for engineers 32

TRENDS IN APPEARANCE DESIGNS. French designs—industrial and consumer, some student subjects 34

DEPARTMENTS:

SIDELIGHTS 2

LETTERS 4

HORIZONS 17

SIGNIFICANT COMPONENTS 36

NEW LITERATURE 46

PUBLISHER'S POSTSCRIPT 48

FYI PERSONAL 49

WHY NOT R & D? 50

FIELDS OF INTEREST:

MATERIALS:

Chemical insulator for copper coming 5

Pure chromium need not be brittle. 8

Liquid structure based on the molecular theories 10

Cost patterns—minor metal prices down. 12

PROCESSES:

Alloys of dissimilar metals made by bombardment 5

Ultrasonic decontaminators remove radioactive particles 8

Automation with quality control built in 20

ELECTRICAL:

Heat to electricity with semiconductors. 8

Wire harnesses made from plastic coils. 8

DESIGN:

Industrial air conditioning—what users think of it. 5

"Hot" launching pads complicate nuclear rockets. 10

Gear lubricant deposits web rather than film 12

Statistical analysis concepts aid design 21

Million-pound-thrust rocket project for Rocketdyne. 22

TEST:

Ultralow temperature research goes into high gear 10

Thermal shock test for glassed coatings 12

Rolled beryllium sheets tested for Air Force 26

GOVERNMENT:

Space Agency funds cut by Congress. 7

Second moon shot set for September. 7

Product Engineering . . . . . SIDELIGHTS

R and D RESEARCH news edition DEVELOPMENT

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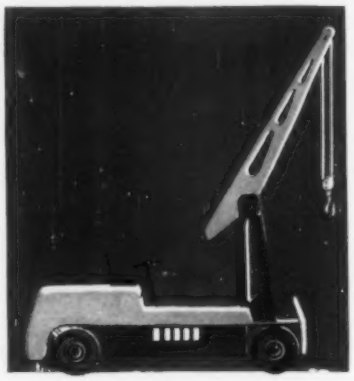

● **Despite major political upheaval,** France continues to turn out superb wine, the styles that clothe the world's women, and many really exciting product designs (p. 34). Their automobiles have fewer pushbuttons maybe, but a test run last year by Chrysler's De Soto Division makes us wonder whether pushbuttons are that all-important. The company sent out two cars on a 2300-mile drive. One, a brand-new model, had power steering, power brakes, and automatic transmission, etc. The other was a 1929 roadster in perfect condition. Experienced drivers alternated cars and were blood-tested and examined for fatigue every night by doctors. Results: The drivers were equally fatigue each night. Detroit prefers to forget the whole thing.

● **Surveys and statistics** on what the American public thinks about everything from TV programs to psychiatry have become so popular you can't open a newspaper or magazine without tripping over one. The latest rage, of course is science. The Survey Research Center of the University of Michigan reports 83% of persons interviewed felt "the world is better off because of science." But 41% thought scientists were "odd and peculiar people," 33% had never heard of radioactivity (one individual said radioactivity is "any program that is on the air"), 26% had never heard of fluoridation of drinking water to prevent tooth decay. The 1950 census reported 96.8% of Americans can read . . . they just can't seem to find anything worth reading.

● **The researcher,** respected by the general public and of such concern to management (p. 30), has finally broken the advertising barrier. New York subway placards, extolling Viceroy cigarets, picture an intense, cigaret-smoking man whose eyes seem to bear the weight of centuries. In the background you see some laboratory glassware, a blackboard with symbols, and the copy reads, "The man who thinks for himself. . ."

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PLASTICS NEWSFRONT

Plastic Drink Dispensers Take Rugged Fountain Use

These attractive over-counter soft drink dispensers must resist impact, denting, corrosion, staining and scratching. So the Cornelius Company molds base, front and back panels of tough CYMEL® 1077 melamine plastic, which also provides the advantage of light weight—important in shipping and installing. Dispensers can be kept sanitary simply by washing with hot water and soap or detergent. Ordinary care will keep them bright and gleaming for a fountain's lifetime.

Lightweight and Portable— New Idea in Business Machines

This midget Underwood Add-Mate electric adding machine weighs just 7½ pounds. It can be toted easily from desk to desk or office to home, and slipped out of sight in a drawer when not needed. Contributing to its light weight, handy size, and durability is the attractive two-toned, two-piece housing molded of CYMAC® 201 methylstyrene-acrylonitrile copolymer. This plastic is tough, hard, and resistant to heat, staining and denting. Unharmed by the diester lubricant applied to the mechanical assembly, the CYMAC housing has the extra advantage of chip-proof molded-in color. This elimination of finishing simplifies manufacture.

Plastic Pipettes, Break-resistant and Boilable

Break-resistant, glass-clear droppers that can be boil-sterilized are among the growing number of products being made of versatile CYMAC 201 methylstyrene-acrylonitrile copolymer. Plastic Assembled Products, Inc. produces pipettes in sizes from 1½ inches to 3½ inches on high-speed injection molding machines, twenty-four units at a time. Dropper closures, in every color for quick product identification, are molded of Cyanamid's BEETLE® urea molding compound.

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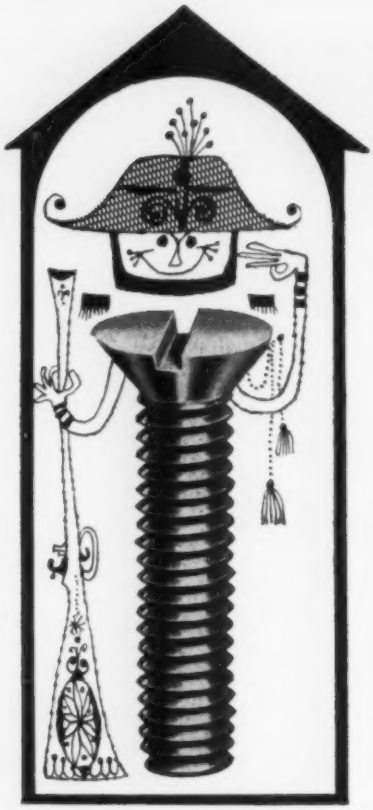

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READER TO EDITOR

To the Editor:

No one has ever come up with words which clearly distinguish between research and engineering (July 28, p 17). Moreover, I have reached the conclusion there is no definite line between research and engineering. However, it all seems to make sense if identified on a time basis. Very-long-range research falls into the field commonly known as basic research whereas short-range research immediately preceding production of the article is definitely in the field commonly known as engineering. This provides a convenient means of classifying projects as engineering or research. For example, work directed toward proving a device for production or commercial use is engineering. Work directed toward developing devices which may be designed for production or commercial use can then be logically classified as research, which becomes basic research if it is very long range.—A. W. POPE JR.
Chief Research Engineer
Waukesha Motor Co.
Waukesha, Wis.

Damn the Definitions—Full Speed Ahead!

To the Editor:

"Engineer's Catechism," (July 28, p 17) is quite an editorial for a man of science. The "weight of centuries" did not hinder the disuse of torches and the adoption of kerosene lamps, or the present use of electric lights. With these new perceptions, and others, man should "disburden the memory of its hoarded treasures as old rubbish."

One would think and expect an engineer, of any category, to be the first to comprehend such logic. Please, Mr. Editor, be calm and unemotional; and refer to your very fine editorial entitled: "Trouble-makers." —WHITNEY E. GREENE
Los Angeles

Why Not 5-cylinder Engines?

To the Editor:

A letter in the July 21 issue (p. 24) bewails the present-day trend in automobile design, and mentions a "5-in-line" built experimentally by Ford in 1942. I have never heard of this particular engine before, but I can personally vouch for the fact that there is nothing wrong with the five-cylinders-in-row idea, or with seven-in-a-row.

In the dim, distant days of 1927 and 1928, I ran into a fellow named Wallace McCoy. The upshot of our acquaintance was that I designed a series of special built-up crankshafts and camshafts for Mr. McCoy for use in 5-cylinder and 7-cylinder engines. He built several 5-cylinder jobs and one of the 7-cylinder type. His method was to buy a "6" or straight-8 engine, junk the standard crankshaft and camshaft, and replace them with the special shafts, equipped with standard pistons, rods, valves, etc. The ignition systems were rehashed and equipped with special distributors.

I remember driving one of the 5-cylinder cars around San Antonio. The smoothness of operation was really amazing. Its only fault was in its lack of "getaway" from traffic-light stops. I didn't have an opportunity to drive the 7-cylinder job, which was built into a Packard straight-8 engine, but Mr. McCoy told me it was much better in all ways than the "5."

His theory was that having only one piston-and-rod unit reach dead center at a time would lessen vibration and inertia forces very considerably, and from my experience in driving the 5-cylinder car, I think maybe he had something—why not?
—LARRY COBURN
Akron, Ohio

New Twist in V-belts

To the Editor:

Mr. Koslow suggested (July 28, p 42) a Pentagonal-section V-belt. How about manufacturing the belt-loop, as required, but with a one-fifth twist through its closed length, thus eliminating any need to rotate the wearing faces periodically, as stated by Mr. Koslow? As can be determined, such a belt would be running over the successive drive and driven sheeve faces with a fresh pair of drive faces for each complete circumferential traverse of the belt length.

As a matter of further consideration in the use of a twist in endless belt drives, a square cross-sectioned belt with a quarter twist through its closed length, and with rack-tooth-form corrugations on all four of its driving sides should find many applications in the field of light-power timing and sequential rotational drive mechanisms. This is just an additional thought on the over-all picture of improved service life and greater versatility of endless belt applications. —FRED S. BEACH JR.
Alameda, Calif.

First Check Employes' Handwriting

To the Editor:

I am surprised that Mr. Lichtgarn (June 16, p 30) did not mention one way, widely used in Europe, to spot good and bad engineers—Handwriting Analysis.

For 30 years, I have used a graphologist to examine all applications for my laboratories. I could give dozens of examples of how the handwriting reveals the personality far better than an interview or even an acquaintance of many years. I know a company president who had a male secretary who, for many years, had cheated him left and right. A cop of his hardwriting was sent to a graphologist. When the expert saw his handwriting, he said, "He drinks heavily. Do not trust him in the least." Then all his misdeeds came to light.

I would recommend that you have the writing of a few good or bad engineers examined by a good graphologist (names upon request). The charge is very small, about $2 for an analysis of two pages.
—GEORGE KEINATH
Larchmont, N. Y.

American ... DEVELOPMENTS TO WATCH...

What's needed in industrial air conditioning? . . .

. . . Here's a report that provides a clue:

A survey of more than 5000 industrial, commercial, and retail establishments in 103 localities shows most are satisfied with their units; but of those who are not, 36% say they "don't cool enough," and 23% say they're "too small"; while a bare 7% complain of too much cooling, and only 14% have maintenance gripes.

As to trends in air-conditioner types, the survey shows room and package conditioners are gaining on central systems in percent of total sales. But this is probably because the growth of air conditioning in larger establishments took place earlier. Now the smaller ones are catching up, giving the smaller units a boost.

The industrial air-conditioning market, incidentally, is still a tremendous one. Among manufacturing establishments the study, sponsored by DuPont, finds only 12% wholly air conditioned, and 69% have no air conditioning at all.

Alloys of vastly dissimilar metals . . .

. . . may be created by a new bombardment technique in which particles of one metal are literally shot into the crystal lattice of another, Air Research and Development Command reports.

The technique could pave the way for production of new organic compounds as well—silico-halides, for instance. These are theoretically possible, ARDC notes, but cannot now be produced because of the exceedingly high energies required for polymerization. Use of a particle accelerator to bombard one compound with another might do the trick.

Engineers at Bolt, Beranek & Newman, Inc, of Cambridge, Mass., who are working on the metals aspect of the technique under Wright Air Development Center sponsorship, emplasize it is still very much in the exploratory stage—far too early, they say, to state that high-speed projection is a commercially feasible alloying technique. But results so far warrant further study.

BB & N is planning to investigate the types of alloys that might be created and the kinds of instrumentation (the linear particle accelerator is only one of several possibilities) that might be developed to achieve high particle acceleration.

A "chemical insulator" for copper . . .

. . . that may permit its use in the presence of lube oils and gasolines that ordinarily have harmful catalytic effects has been developed by DuPont's Petroleum Chemical Div. It's still experimental, but the company says it "appears to be remarkably effective in suppressing pro-oxident effects of metallic copper and copper alloys . . . and its ability to chemically insulate copper surfaces is a unique performance quality not exhibited by the conventional metal deactivators which function principally by deactivating dissolved or soluble copper." The compound itself is an organic, has no metallic elements.

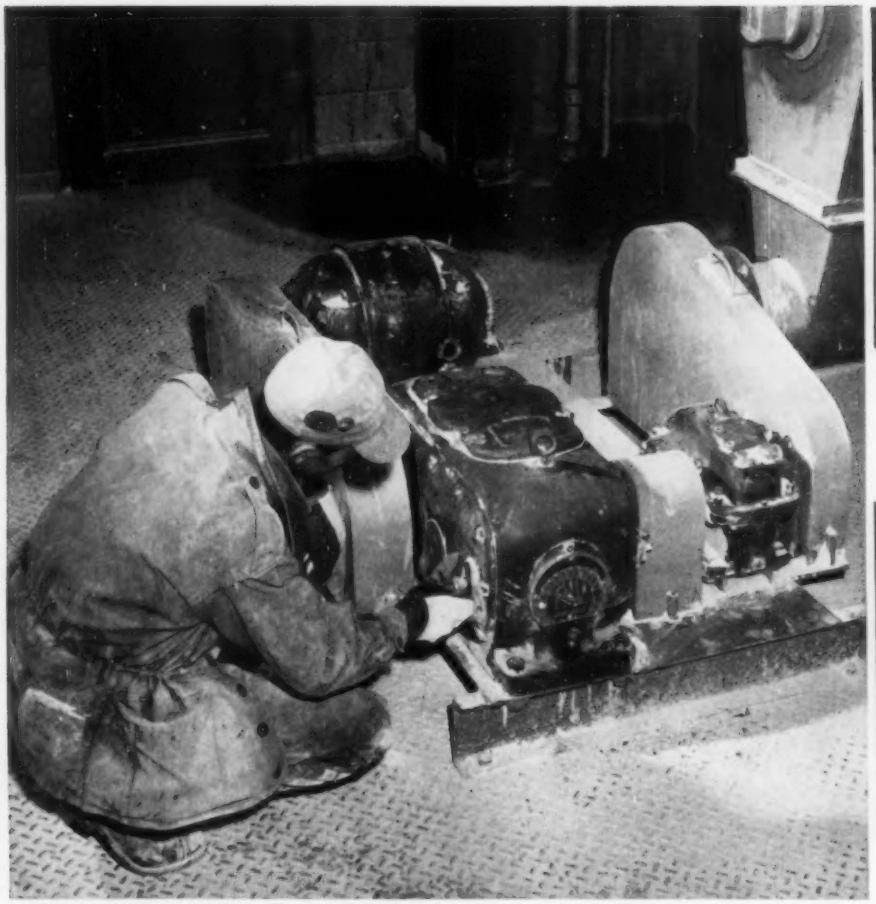
High-speed typing perforator . . .

. . . that prints a message and codes it at the same time has been developed by Kleinschmidt Laboratories, is being readied for commercial introduction.

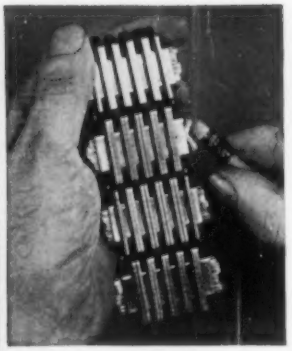
Designed to receive either sequential or simultaneous signals in the Baudot code, it punches and prints on $\frac{7}{8}$-in. tape at rates from 60 to 750 words per minute. Tape feed-out is at the rate of 3600 operations a minute. —ARG

U.S. Army Photo

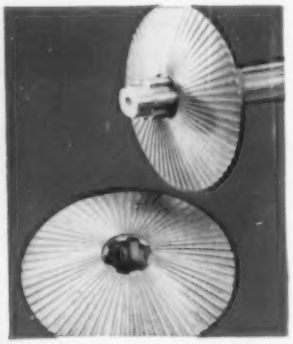
Messages are printed and punched at the same time by this compact 55-lb unit. It operates on ac at standard voltages and frequencies.



INSTANT SPEED CHANGING. To get desired output rpm, operator simply turns handwheel to desired position on easy-to-read dial. P.I.V. responds instantly, accurately. Drives are also available with automatic, electric, pneumatic or hydraulic controls.



SELF TOOTH-FORMING CHAIN consists of a series of steel laminations, serving as teeth, which are free to move from side to side, either singly or collectively.



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DEVELOPMENTS TO WATCH...

Space Agency Cut

After all the Congressional fuss and bother over the "inadequacy" of the administration's plans for space exploration, the lawmakers cut $45-million from the FY 1959 appropriation for the National Aeronautics and Space Administration. Congress voted $80-million in new funds for the new civilian space agency, slashed $20.2-million from NASA's research and development request, $22.8-million from the construction and equipment program, and $2-million from the money request for salaries and administration expenses.

The budget cut comes as a rude shock to the civilian space agency planners. If anything, they had thought it likely that Congress might tack on funds to the NASA appropriation request–as had been done to the Defense Dept.'s budget for missiles and other new weapon development projects for which Congress has been unusually generous.

In addition to the $80-million in new funds, NASA's program will be financed this year by $117-million transferred from the Defense Dept.'s Advanced Research Projects and $101.1-million which was previously appropriated to its predecessor agency, NASA.

Moon Shoot Engineers

The Air Force's second lunar probe attempt is now set for some time between Sept. 14 and 16. Private contractors–both industrial and scientific–are actually pulling the strings on the project. The Air Force says 52 contractors are participating.

Over-all technical direction and systems engineering is in the hands of space technology laboratories, a Ramo-Wooldridge Corp. subsidiary (now being organized as an independent operating organization to allow R-W a better chance to compete in missile hardware development). STL has conducted R & D on components and subsystems for the lunar probe project and has supervised development of hardware for the second and third stage rockets and payload.

Its major subcontractors are Hallamore Electronics, Atlantic Research Corp., Pacific Automation Products, Rantec Corp., Reeves Instrument Corp., Summit Industries, Western Electric, and RCA.

Major contractors on the lunar probe vehicle's first stage rocket (the Thor IRBM) are North American Aviation's Rocketdyne Division and Douglas Aircraft; on the second stage, Aerojet-General Corp.; on the third stage, Allegheney Ballistics Laboratory (operated by Hercules Powder Company).

Boost For Atomic Designers

The US Atomic Industry is being sounded out on a long-range reactor development program aimed at making nuclear power economical in the US by 1970, or shortly thereafter.

The plan, published as a staff study by the Joint Committee on atomic energy, contemplates private or federal construction of 10 or 12 reactors with a total capacity of some 1-million electrical kilowatts.

Estimated cost: $875-million of government and private money over a seven-year period.

After receiving industry comments this fall, the Committee will try to hammer out final agreement with the Atomic Energy Commission.

AEC, meanwhile, is progressing toward the goal of learning to use plutonium as a reactor fuel. A plutonium-fueled reactor has operated at substantial power levels for the first time.

However, experts say it will take years of research before plutonium can be recycled with natural uranium, thus cutting atomic generation costs.

Atoms For Ships

Nuclear propulsion is coming up fast in its bid to push merchant ships around the oceans. Experts already claim atom-powered tankers could compete with conventionally-propelled vessels on long trade routes where high speeds are desired. But so far only one A-powered ship, the government's N. S. Savannah, passenger-cargo vessel, is under construction.

Now the government plans to help foot the bill when a private ship owner is ready to install atom power in a vessel of his own. Washington will probably pay about half the increased cost of nuclear power over conventional propulsion. But ship owners are still going slow on the offer, waiting for new reactor designs now in the works to be proven.

World-wide ...

DEVELOPMENTS TO WATCH...

Two ultrasonic decontaminators . . .

. . . for radioisotope laboratories and other atomic-energy installations, are being introduced by Mullard Equipment, Ltd, Torrington Place, London, WC 1, at the Geneva Atoms for Peace Exposition. Like other ultrasonic cleaning devices, they're designed to take advantage of the agitation produced by high-frequency sound waves to remove clinging particles; and, in this case, to permit more thorough removal of radioactive materials.

One is a fairly standard bench-type unit, with dual tanks driven by 40-kc/sec barium-titanate transducers, pulse-operated from a remote 250-kw generator. The other has several special features to facilitate handling of "hot" items and disposal of waste fluids which contain radioactive materials. It's adaptable to automatic handling, has provision for continuous feeding of detergent, has provision for pumping and filtering waste fluids. This unit uses a 20-kc/sec magnetostriction transducer system, energized by a 2-kw generator.

Pure chromium need not be brittle . . .

. . . and high-chromium alloys with good ductility can be prepared, say researchers at Australia's Defence Standards Laboratories at Maribyrnong. Their latest report claims to have produced pure chromium metal with a ductility of about 65%, capable of room temperature reductions of more than 50% on an area basis—"about the same as those to be expected of an ordinary mild steel under similar test conditions," they say.

The secret of their success: control of impurities (especially nitrogen), and the application of several newly developed processing techniques.

Nitrogen, they say, "exerts a profound influence, even at levels of the order of 0.001% by weight." Metal containing even this tiny amount shows no measurable ductility below 600 F, though it is ductile above that point. The gaseous element seems to have a precipitation-hardening effect.

Work on high-chromium alloys is still in its early stages; but chromium-tungsten alloys look extremely promising, though much work remains to be done before the desired level of room-temperature ductility is achieved. (For a preliminary note on this research, see *PE*—June 16, p 8.)

Latest report on Soviet research . . .

. . . in thermoelectric heating (*PE*—July 14, p 8) describes a steam boiler electrical generating system that eliminates the conventional generating units. Instead, the conversion from heat to electricity is accomplished with semiconductors. Disks of a zinc-antimony semiconductive material are so arranged that one side is heated by the combustion gas and the other cooled by the water in the boiler. The difference in temperature between the gas (1300 F) and the water (212 F) causes a current to flow. There are no claims of low cost or efficiency, though. (For related US research, see *PE*—Aug 11, p 5.)

Plastic anti-abrasion coils . . .

. . . for protecting cable in harness assemblies, flexible tubing, and small-diameter pipe lines have been developed by Creators, Ltd, Sheerwater, Woking, Surrey, Eng.

Made of polyvinyl-chloride plastic, the coils are acid-resistant, and said to withstand "very high pressures" before crushing. As the photograph indicates, the coil strand is not round but semicircular in cross-section so the inside surface is flat and smooth.

Protective coils can be made in continuous lengths, in bores from ½ in. to 2 in. Cost varies with size, type.

SEPT.
1958

Plastiatrics

DOW'S CLINICAL APPROACH TO HEALTHY PLASTICS APPLICATION

DOW

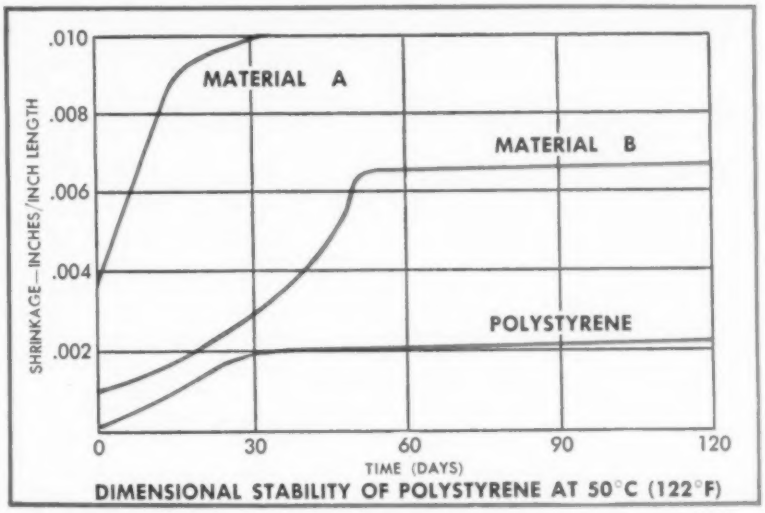
SUPERIOR DIMENSIONAL STABILITY OF STYRON® ASSURES ACCURATE, LASTING FIT

OTHER ADVANTAGES INCLUDE EASY FLOW, HIGH GLOSS FINISH AND HIGH IMPACT STRENGTH

Polystyrene has better dimensional stability than any other thermoplastic material (see chart at right). Even when subjected to elevated temperatures over a period of time, polystyrene retains its dimensional stability better than the two next best materials that could be used.

Styron (Dow polystyrene) is especially suited to molding applications where complex, dimensionally accurate parts are a "must". A case in point is the fan housing shown below. Since both halves of the housing are made from the same mold, dimensional stability is very important. The slightest misfit would detract from the attractiveness of the finished unit. Other reasons for selecting a Styron formulation for this application were its superior impact resistance when tested against an identical metal housing and its high gloss finish.

Styron is available in twelve different formulations which offer a wide range of properties including easy flow, high impact strength, high gloss, and wide choice of colors. If your product can be molded from a polystyrene material, you can be sure a Styron formulation will offer the right combination of properties to mold it properly and economically.



DIMENSIONAL STABILITY OF POLYSTYRENE AT 50°C (122°F)

A continuing series of Plastiatrics studies by Dow Plastics Technical Service Engineers has produced a wealth of information on polystyrene, its dimensional stability, mold shrinkage and thermal expansion. This information is available to you. Address your request for a copy of "Dimensional Tolerances of Polystyrene Moldings" to THE DOW CHEMICAL COMPANY, Midland, Michigan, Plastics Sales Department 1524D.

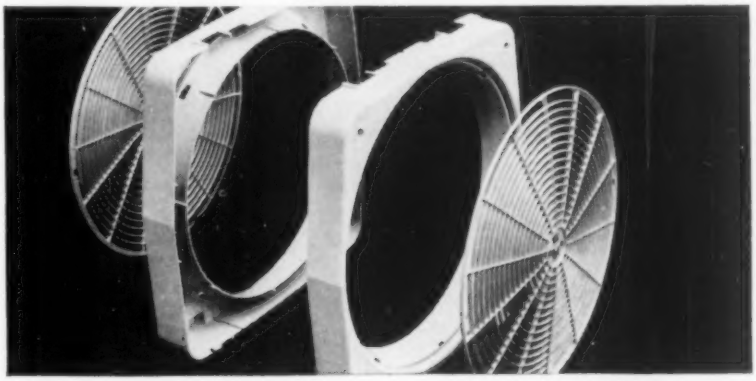
AMERICA'S FIRST FAMILY OF POLYSTYRENES

GENERAL PURPOSE
STYRON ℬ666
STYRON 666M (Easy Flow)
STYRON 689 (Easy Flow)

MEDIUM IMPACT
STYRON 777
STYRON 330 (Easy Flow—Translucent)

HIGH IMPACT
STYRON 475
STYRON 475M (Easy Flow)
STYRON 440 (Heat Resistant)
STYRON 440M (Easy Flow)
STYRON 480 (Extra-High Impact)

HEAT RESISTANT
STYRON 683
STYRON 700



YOU CAN DEPEND ON DOW

What's happening in SCIENCE

Freezing materials to free their secrets

A good many hopes for improving materials and developing new components are pinned on research at ultralow temperatures. A few such devices are already in use—masers' for the microwave field (*PE—Jan.* 13, '58, p 10), cryostats as computer memories (*PE—Dec.* 2, '57, *p* 16).

But these are only the beginning.

At ultralow temperatures—within a few degrees of absolute zero (−459.6 F), nonmagnetic materials become magnetic, insulators become conductors, and many other remarkable changes take place—changes that help uncover fundamental facts about materials themselves—explosives, for example. That is why the Army Engineers have set up a major cryogenic (ultralow temperature) explosives research program (photo below) and the Bureau of Ordnance has just given Armour Research Foundation a $21,000 grant for low-temperature crystallographic studies of explosives.

Coming within about half a dozen degrees of absolute zero is not particularly difficult. Liquid helium (−453 F) will do that. But getting below that point is no simple matter. Those last few degrees are like a million miles. One approach is using an exceedingly powerful electromagnet to, in effect, slow down the individual molecules or atoms and thus reduce their temperature. By this means, temperatures within half a degree of absolute zero are possible.

Until now, there have been few, if any, magnets built specifically for this job; and, while such temperatures could be reached, they could not generally be held. Now, though, such magnets are being built (*PE—Aug 4, p* 24), and new and more accurate entropy measurements and other data can be expected.

What makes a liquid?

We don't know enough about liquids—not nearly as much as we know about the other states of matter—says J. S. Dahler of Wright Air Development Center.

This is not surprising because the structure of liquids and the interactions of their molecules are so much more complex than those of gases or solids. For instance, there is little molecular movement in solids, and little chance of collision between moving molecules in gases. But the molecules in a liquid are in a continual traffic jam.

Many theories are being developed to explain and predict molecular motions in liquids. But perhaps the most interesting trend is toward theories which postulate molecular "holes" as determinants of thermodynamic properties. These "holes" are actual voids in the crystalline lattice structure rather than theoretical vacancies like the electron "holes" used to explain semiconductors (*PE—Aug 25, p* 10 *and Sep* 15 issue); and differences in the number and distribution of molecular "holes" can be used to predict and explain observed phenomena.

Also showing promise are cell theories which consider liquids as having their molecules centered in lattice-like cells. In recent extensions of these theories, these cells are considered to be in clusters whose volumes are shared by the molecules within them, the degree of sharing being a function of the density of the fluid and the mobility of its molecules.

Dahler believes this "cell-cluster" theory can be generalized to include the principles of the hole theories and that, perhaps, a combination of both will prove the most valuable.

Much work—both mathematical and empirical—is being done on this problem, and much is needed. But, says Dahler, "during the next few years, calculations based upon these schemes should gradually become available and then a truly comprehensive appraisal . . . will be possible."

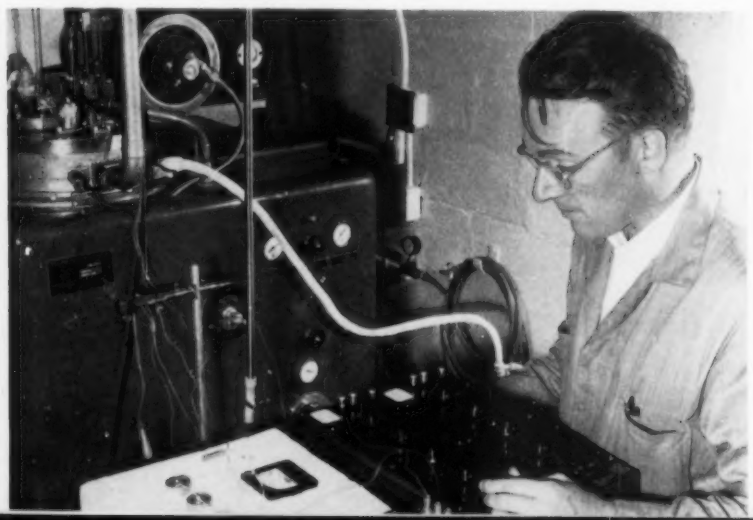
Another hurdle on the way to space?

"Hot" launching pads may be one of the vexing problems of the nuclear missile age, testimony by Dr. Raemer Schreiber of Los Alamos indicates. He sees likelihood that there will be some ejection of fission fragments with the coolant or propellant as the nuclear engine goes into operation. That means the launching pad itself will be contaminated to greater or lesser degree.

This contamination endangers no large area—but it might mean that launching pads could not be reused for quite some time; and launching pads of any kind are expensive.

Compared with problems of developing the engine itself, this is perhaps only a minor headache; but a good indication of what must still be done before the space reactor becomes a practical reality. —ARG

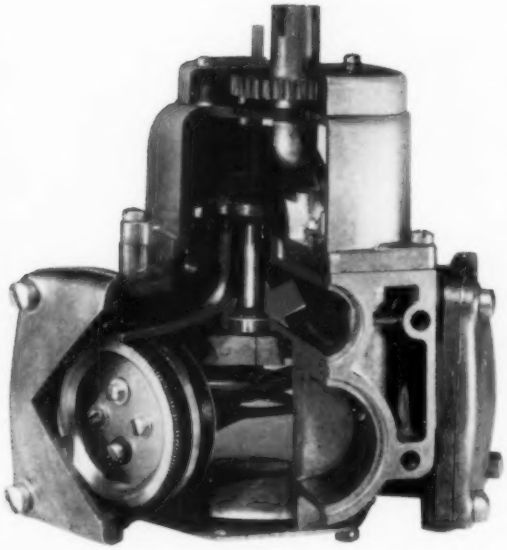
Engineers are freezing explosives at Ft. Belvoir R & D center to find out what makes them tick. Here, Army scientist calibrates a carbon-resistance thermometer (foreground) for use with a helium cryostat (background) that produces near-zero temperatures.



VITON

TRADEMARK

A New Synthetic Rubber from Du Pont Serves Where Other Elastomers Fail



In this meter for gasoline pumps, the O-ring seal on the output shaft is exposed to aromatic components in high octane gasolines. A noted oil-resistant synthetic rubber was first used for the O-ring. It became swollen, however, and caused metering difficulties. When an O-ring of VITON was substituted, the trouble was eliminated.

Gives unequalled service in oils, fuels, solvents and chemicals at temperatures over 400° F.

VITON synthetic rubber combines high resistance to most fluids and corrosive chemicals with outstanding resistance to high temperatures—up to 450° F. in continuous service, up to 600° F. in intermittent service.

VITON offers excellent mechanical properties for a fluid and heat-resistant elastomer. Specimens return to within 90 to 97% of their original dimension after being compressed 25% for 70 hours at 250° F. At room temperature, tensile strength tests out from 2000 to 3000 psi, and ultimate elongation from 100 to 400%, depending upon hardness.

VITON is easy to process; components can therefore be made to close tolerances. This new synthetic rubber has already proved successful in precision seals (such as the one shown here), diaphragms, coated fabric and linings. To learn more about VITON, see your rubber supplier or send for our new booklet. E. I. du Pont de Nemours & Co. (Inc.), Elastomer Chemicals Dept. PE-9, Wilmington 98, Del.

RESISTANCE TO FLUIDS AND CHEMICALS

VITON vulcanizates were immersed for 7 days in a wide variety of corrosive fluids. These data show the effect of representative fluids upon the properties shown.	**Tensile Strength Retained %**	**Hardness Change Points**	**Volume Increase %**
Carbon tetrachloride, 75° F.	85	+ 2	1.3
Aniline, 75° F.	100	— 1	3
Tricresyl phosphate, 300° F.	93	—11	24
JP-5 petroleum aircraft fuel, 75° F.	100	+ 1	0.4
Turbo oil No. 15 diester lubricant (Mil-L-7808), 400° F.	60	— 6	19.6
Transmission fluid, Type A, 212° F.	77	— 1	1.5
OS-45 silicate ester, 400° F.	62	— 3	11.1
Sodium hydroxide, 46.5%, 75° F.	75	+ 1	2.1
Hydrofluoric acid, 48%, 75° F.	98	+ 2	4.8
Sulfuric acid, fuming, 75° F.	58	— 4	4.8

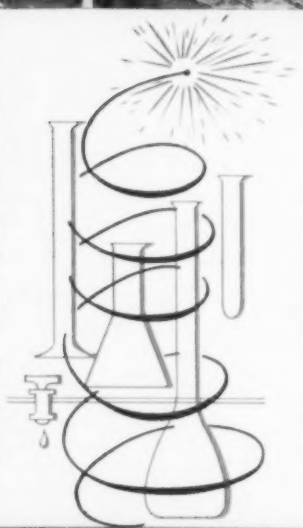
VITON

DU PONT

Better Things for Better Living
. . . through Chemistry

modern finishing equipment

Gilbert Gleichner, "pushbutton electro-chemist" and operator of our newest Stevens automatic anodizing unit. Bert says he's getting more done, better, in less time, than he ever has before.

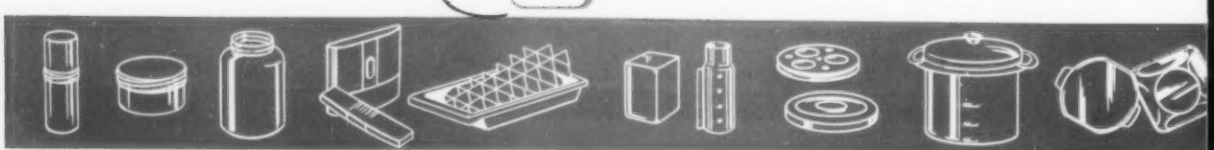


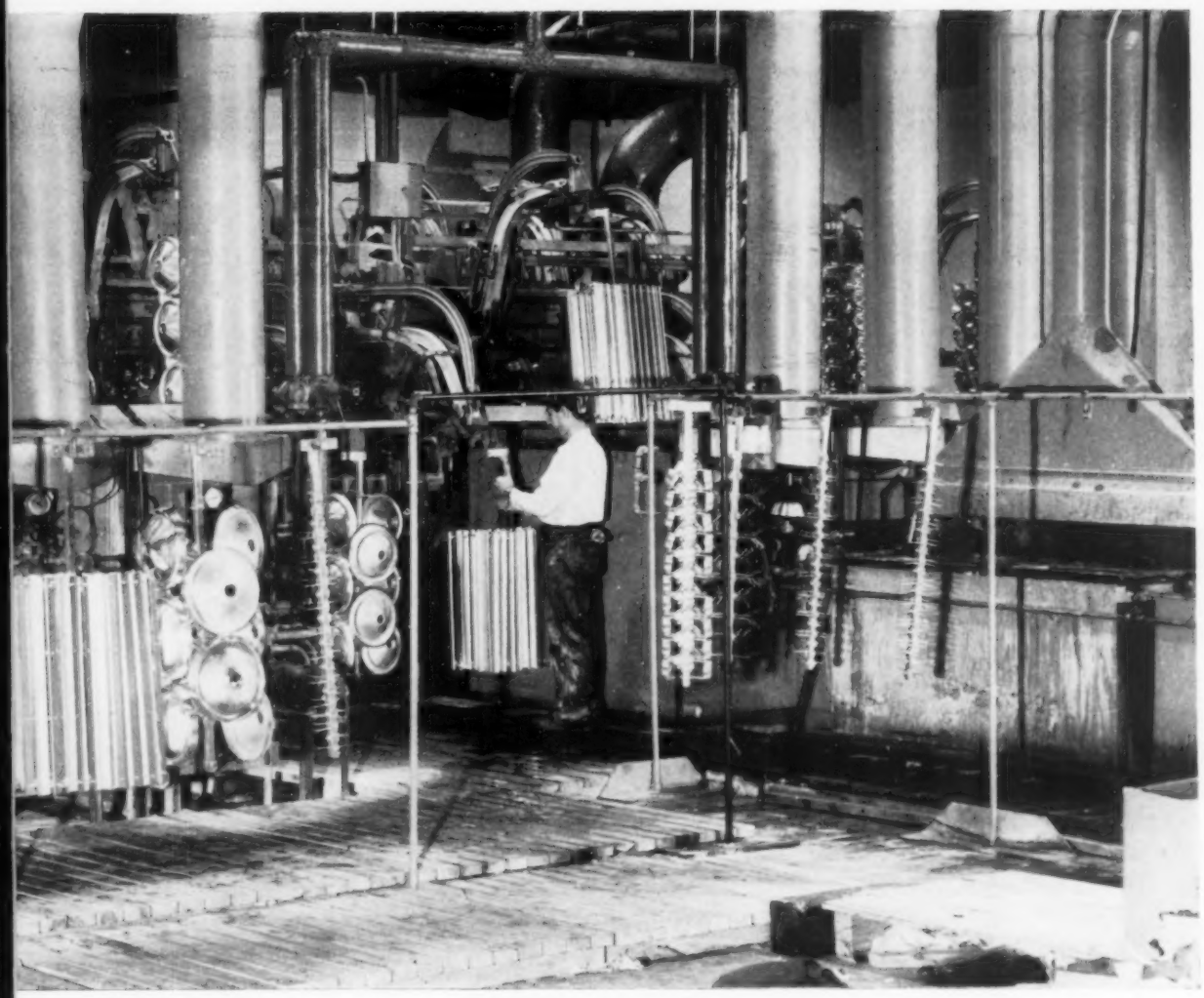
...a part of

FOR

This mechanical wonder, a completely automatic anodizing unit, can carry thousands of component parts through the entire anodizing process at a predetermined cyclical rate that sets up optimum immersion for the job in hand, *ruling out the human element of variation in manual and semi-automatic operation!*

Benefits to you are obvious. A finer anodic finish in natural, bright, or color . . . at lower cost . . . with on-schedule delivery. And, best of all, components in *final* form, ready for





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application to your product on your own assembly line.

Why not review your component requirements? If it can be made of aluminum—stamped, drawn or rolled-formed—and you need large volume, high-speed, quality production, get in touch with us. The anodic unit above is one of our many finishing units capable of a variety of mechanical, chemical finishes. All part of our mill-to-final-finish facilities, at your service.

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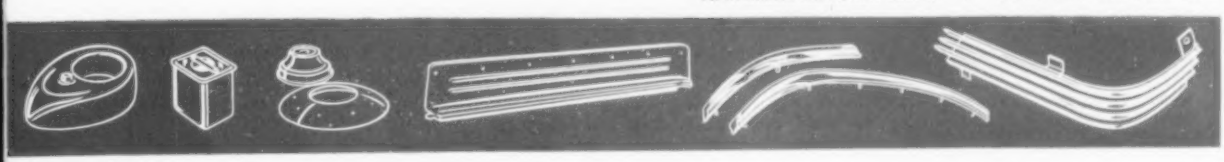


What's happening in MATERIALS

Lubricant spins a web

A gear lubricant that deposits a stringy web of grease instead of the usual film, is making its debut on the consumer market, packed in aerosol spray cans, but will soon be offered for industrial use.

As the manufacturer describes it, the lubricant forms an extremely tacky surface "within minutes after spraying." Then, as the gear rotates, there is a stringy, webbing effect, carrying the lubricant from one tooth face to another. It's a petroleum product that can be used as a heavy-duty lubricant on printing or construction machinery, farm equipment and machine tools.

Acrolite Products, Inc., West Orange, N.J., will supply the consumer market and a major oil company plans to enter the industrial field.

Glassed coatings gain shock resistance

"Glass" coatings for steel offering 30% greater resistance to thermal shock and 20% greater resistance to abrasion are now available, says Pfaudler Co, as a result of new developments in thermal shock technology.

The company bases its claims for its latest coating, *Glasteel* 59, on a new test method which, it says, makes it possible to catalog specimens as to thermal shock resistance and susceptibility to surface failure.

The test setup consists of a timed, conveyorized system that carries samples through a controlled-temperature furnace and then over a cold-water quenching jet. Samples are examined and classified visually (see photo).

This system, applied to samples prepared with various combinations of glass formula, base metal, and temperature, makes it possible, Pfaudler researchers say, to find the best one for each specific product need.

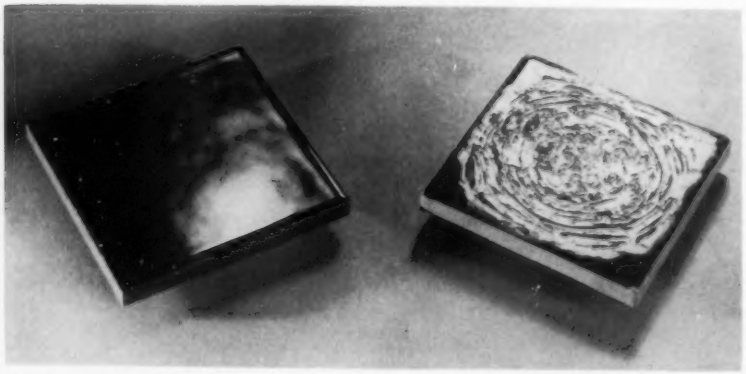
briefs . . .

Polyethylene can be glued, easily and at high speeds, DuPont reports. A new process, developed at Lowe Paper Co, is said to permit bonding of polyethylene-coated materials on standard equipment, may well open the door to new applications for such materials in electrical and thermal insulation.

Foamed aluminum is now being cast to shape by at least one supplier. Foamalum Corp, Box 445, LaSalle, Ill., says this new material (*PE—July 21, p 17*) can be poured into "fairly intricate shapes with a reasonable control of density" in the range of 12 to 40 lb/cu ft. Both shell-molded and sand-cast parts can be made. Foamalum says, at prices ranging from $1 to $2.25, depending on part design, alloy used, and density of finished product.

Ceramics that are "essentially nonleachable" have been developed at AEC laboratories as one phase of research on disposal of nuclear reactor wastes. The AEC's interest is in finding a material that will be suitable for burying radioactive materials at sea. But the fact that relatively low-cost combinations of clay, glass, or synthetic minerals with lime, borax, and sand, can be made almost completely resistant to water might well pave the way for industrially useful materials.

Purer metal at lower cost is the goal of several research programs outlined by the Bureau of Mines for the coming year. For instance, the Northwest Electrodevelopment Laboratory, Albany, Ore., will study half a dozen techniques for refining columbium and tantalum, and major attention to other "exotic metals" is planned. Among the most promising techniques, says the Bureau, are solvent extraction (already in commercial use, but slated for improvement), fractional distillation, Kroll-process reduction, closed bomb reduction, arc-melting and electron-beam melting.



Crazing pattern of glass-coating-that-failed (right) is clearly visible, easy to catalog. At left is sample that came through Pfaudler's new thermal shock test unharmed.

How cost patterns are changing: Metals

While the Big 3 (steel, aluminum, copper) ride the price roller coaster, creating plenty of design headaches (see p 17), there is good news from the minor metals.

Platinum, for instance, has been going down steadily, from an average last year of more than $90 per troy oz to less than $65 now. Antimony and cadmium, too, are down; the former to 29-32¢ a lb, the latter to $1.55.

In the semiconductor group, prices are stable, with any changes in the near future also likely to be on the downside. Germanium is $202-$220/lb; silicon, solar grade $90, transistor grade $130-$335; selenium, $9.50-10.50.

Tin has gone up since early summer, about 2¢ a lb; but it's down from last year by about the same amount. Current range is 94-96¢ a lb.

Also holding firm are most of the "exotic metals"—columbium, tantalum, vanadium, and the like (*PE—Mar 17, p 66*). —ARG

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The oil-resistant, ozone-resistant nitrile rubber

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A development of Naugatuck research makes it possible to combine in a vulcanized rubber wire jacket all these properties:

- Excellent resistance to ozone and outdoor "weathering"
- Outstanding heat resistance
- High abrasion resistance
- Excellent oil, grease and chemical resistance
- Fast CV extrusion

...**PLUS PERMANENT BRIGHT COLORS**

In addition to the suggested uses, you will think of dozens of other applications where wire jacketing with all these properties can serve either an aesthetic or utilitarian purpose.

One of Naugatuck's technical representatives will be happy to discuss with any prospective user the formulation of the Paracril® Ozo compound which makes possible this combination of properties... not only in wire jacketing but also in shoe soles, hose jackets, weather stripping and other vulcanized rubber products.

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Division of United States Rubber Company

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MINIATURIZATION AWARD

THE AWARD

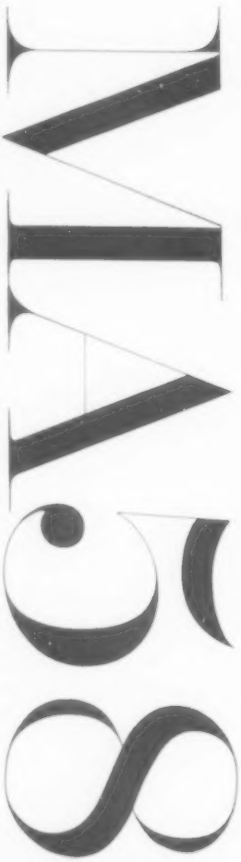
Miniature Precision Bearings, Inc. cordially invites you to participate in the 1958 Miniaturization Award Competition. The Miniaturization Award for 1958 will be presented during the Spring of 1959 at the 2nd Annual Award Dinner in New York. The Award will consist of a piece of original sculpture, symbolizing miniaturization, by a leading American artist, which is cast in bronze and inscribed. Certificates of Merit will also be awarded for additional outstanding contributions.

PURPOSE OF THE AWARD

To increase public knowledge of the importance of miniaturization and to stimulate further activity within industry toward the advancement of the concept of miniaturization.

CRITERIA FOR AWARD

Contributions considered for the Award should have been made in the recent past to be eligible for consideration by the Miniaturization Award Committee. Details of criteria on which awards will be based and entry blank can be obtained by writing: Miniaturization Award Committee, P. O. Box 604, Keene, N. H.



JUDGING OF ENTRIES

The entries will be judged by an independent committee comprised of members of the electronics, metalworking, research, and publishing fields.

ENTRIES

Description of a specific contribution should be made in as complete a form as possible and mailed to the Miniaturization Award Committee, P. O. Box 604, Keene, N. H. Samples of the product itself, blueprints or photographs will be helpful. Descriptive information should include some of the design characteristics of the product and the problem solved by the miniaturization effort.

DEADLINE

In order to be considered for the 1958 Miniaturization Award, entries must be received by January 31, 1959.

SNAFU may be NORMAL

Steel-price increases, rumored for weeks, finally come in a rush. Tire prices go up while rubber prices go down. Non-ferrous metal prices act like a balloon in a breeze. Engineers, in some confusion, hope that prices will stabilize, that the situation will return to "normal."

The trouble is that frequent price shifts *are normal*. The situation of recent years, with long periods of price stability followed by step-like increases or decreases, is anything but normal.

So, if we have a "normal" price situation, it will mean added problems for designers. It will put a premium on those who keep up with the news, those who watch day-to-day prices. It will put a greater premium on those who can switch materials in their designs quickly and without complaint.

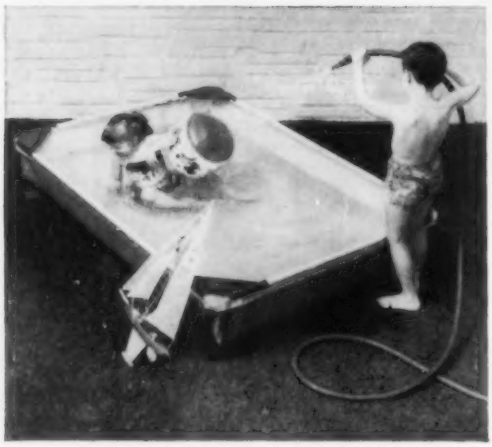
The same goes for parts and components. Flexibility is more than a word under today's competitive conditions. Value analysis, value control—these are phrases for new aspects of cost control, to keep the price within range of the buyer's pocketbook.

The story is told of a Packard designer who came up with a new horn button. It was a lovely thing, but the chief engineer found it would cost about $12, based on that year's production. In a catalog of plastic parts, he found an almost identical one for 36 cents. Guess which button Packard used.

That same designer would be even more troublesome today. There are always several ways to make a part—forming, die casting, powder metallurgy—and at least as many materials from which to choose. The designer must, therefore, consider not only the lowest current cost for value received, but also what tomorrow's relative costs may be. The ideal design is the one that can be shifted easily to suit conditions.

And probably the best business climate is the one in which prices shift from day to day. Such a situation plays into the hand of the designer with the knowledge and skill to anticipate the market, favors the company that is alert and progressive. There's no distinction in doing well when everybody else does.

K. Staugerman



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Enjay Butyl puts *extra life* in a wide variety of rubber-coated fabrics through its superior resistance to tearing, cracking and aging. Leading manufacturers of wading pools, irrigation tubing, auto tops and outdoor covers choose versatile Enjay Butyl because they know it will withstand the traditional enemies of rubber—weathering, sunlight and abrasion.

In many different applications, versatile Butyl outperforms all other types of natural or synthetic rubber. Find out how Enjay Butyl can help you cut costs . . . build more performance into your products. Contact the Enjay Company for the whole story, plus technical assistance when desired.

ENJAY® BUTYL

Enjay Butyl is the greatest rubber value in the world. It's the super-durable rubber with *outstanding* resistance to aging • abrasion • tear • chipping • cracking • ozone and corona • chemicals • gases • heat • cold • sunlight • moisture.

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Chevy Switching to Aluminum Engines? Here are the Clues

NEW YORK—An order received from an American firm by a silent-mouthed British manufacturer of electric furnaces has spurred speculation on the "who-when-and-where" prospects for the aluminum engine in US cars.

The British company is Wild-Barfield Electric Furnaces, Ltd. It has a $300,000 contract to supply 28 mobile induction furnaces, each with 750-lb aluminum-holding capacity. Wild-Barfield declines to name the US buyer desiring this method of transporting molten metal but other information points to Chevrolet Div of General Motors as purchaser. A series of clues all but confirms that Chevy is planning to use the aluminum engine; specifically, an air-cooled, opposed-piston, less-than-100 hp aluminum power plant.

The facts are these:

- Chevy already has a new plant under construction at Massena, N. Y.
- Here it will be neighbor to Reynolds Metal Co, which has been attracted by hydroelectric power of the St. Lawrence and is also building a new plant—for the reduction of aluminum (Alcoa is already producing aluminum here).
- Last year Chevy signed up to take 37,500 tons of aluminum, starting in 1959, from Reynolds' plant. The contract runs for 7 years, with an option to take more of the Reynolds output whose annual production will total 100,000 tons.
- Originally, talk centered around possibility of piping molten aluminum to the neighboring Chevy plant, but final decision was in favor of the "hot metal" method that uses holding furnaces, such as those built by Wild-Barfield, to shuttle the melt from Reynolds' pot line to the automotive plant.

To what extent the aluminum will go into Chevrolet engines still has not been confirmed, but talk is that such engines will be produced next year at Chevy's Massena plant. It is conceded, of course, that the GM division could use the Reynolds output for other automotive parts—for instance, pistons, automatic transmission housings. (At Congressional hearings, this year, the American Die Casting Institute cited a GM promise to buy enough aluminum at Massena to make one-half of the transmission castings needed for total Chevy production.)

At any rate, growing interest of auto makers in the molten-metal method is clear enough. GM's Fabricast Div started buying such melt from Reynolds in 1954 to make various parts and is now consuming approximately 20,000 tons a year. In addition, Ford Motor Co., at Lister Hill, Ala, has this year, for the first time, started buying molten aluminum from Reynolds under a contract calling for consumption of 32,000 tons a year for 10 years—with option to increase its order.

Buying aluminum in this form saves the purchaser some money, although it does require him to build his own permanent mold facilities. By the same token, it also short circuits the casting people who do work for the automotive companies, and gives a better price for aluminum to the auto companies who are geared to that operation than to the casting companies who must buy the aluminum in a slightly more expensive form. For example, Reynolds' molten aluminum price in the contracts with Ford and GM indicates a price of 2½¢-3¢ a pound below the market price for aluminum pig.

David Laine, executive secretary for the American Die Casting Institute, which represents three-quarters of the die casting job shop operators in the country, says that the hot metal contracts presently are having an adverse effect on the small shops, but that in the long run he feels quite sure that the Justice Dept. will find that the molten metal contracts are discriminatory and will not be allowed with such a high cost advantage to the purchaser.

Reservoir of Women Engineers in US Virtually Untapped

NEW YORK—Over the past five years, industry has made a prodigious effort to get engineers. It has scoured the engineering schools for soon-to-be-graduated seniors; has sent employes back to school for more training; has tried a variety of promotional devices to get young people to choose engineering careers. But by and large these recruiting tactics are aimed at men. Relatively little has been done to attract women—perhaps the largest remaining untapped source of engineering talent. (In Russia 20% of engineers are women.)

Enrollments of women in engineering courses are rising—slowly, to be sure, but steadily. The US Office of Education, referring to women as a "source of much needed professional engineering talent often overlooked," reports 683 females were working toward engineering degrees in 1950 and 1783 in 1957. Of those enrolled in 1957, 25 aimed for doctorates and 97 for masters' degrees. Women students are in about every branch of engineering, with a heavy concentration in chemical, electrical and mechanical specialties.

Schools on the whole seem neither to discourage or encourage distaff engineers. Professors generally say the gals get fair treatment during schooling, but one has said the biggest obstacle the ladies have to overcome in school is male resentment.

Getting jobs for women engineers is sometimes difficult. The placement officer of one Eastern engineering school tried to find employment for four lady engineers in the past two years and reports only moderate success—even though the job market last year was the best ever. One woman was a civil engineer—a masters' candidate who was teaching in the department while getting her degree. She finally got a job in design. Two of the others—an electrical and a chemical engineer—were more difficult to place because they were not American citizens. That put them under a double handicap. The fourth lady, a mechan-

ical engineer, got a job that was something of a compromise with her ambitions.

Part of the problem, this placement officer states, is that a woman with a BS can't generally get into R & D. And no matter how good she is, she very rarely gets into production or sales.

As for the women, they have banded into a professional organization, the Society of Women Engineers, whose purpose in part is to improve their employment opportunities. The view of the SWE employment committee, as expressed by chairman Ruth Shafer, is straightforward common sense. Authorities on manpower say a shortage of engineers will be with us for a long time. Dr. Henry H. Armsby of the US Office of Education recently said the demand for technical people will hit 1,250,000 by 1965, but as things are going now, only 686,000 such people will be available. Engineering aptitude, Miss Shafer says, is found in only a relatively small proportion of the general population. But it is found in women as well as men. Under the circumstances, the only smart thing for an employer to do is to hire talent no matter what kind of package it comes in.

Not all women engineers belong to the SWE, but it has over 600 members. In the belief that the professional societies do not provide adequate employment service to their members, the employment committee of the SWE is developing a registry of its members that lists their experience and education. It is hoped that management consultants and employment offices of large corporations will utilize this registry when specialists are wanted. For one company, the SWE found a woman with eight years' experience in audio filters. A recent SWE questionnaire, incidentally, has indicated that 97 of its members are interested in getting new jobs.

SWE members work in about all phases of engineering. At present, 18 are employed in chemical engineering, 41 in mechanical; 12 in aeronautical, 17 in civil, 22 in electrical and 2 in nuclear.

The SWE employment committee also believes much can be done to provide either part-time work or homework for women. Generally, women work for about 5 years, then retire to have families. During the period at home they cannot hold fulltime jobs, but many could continue to make substantial part-time contributions. One member is now designing pressure switches at home.

The SWE employment committee also hopes to show management that women who have retired for a few years while raising families continue to be a potential source of "manpower." Given facilities to brush up on new developments, they could give valuable service for 20 or more years after their children get into school.

Build Quality Control into Automation

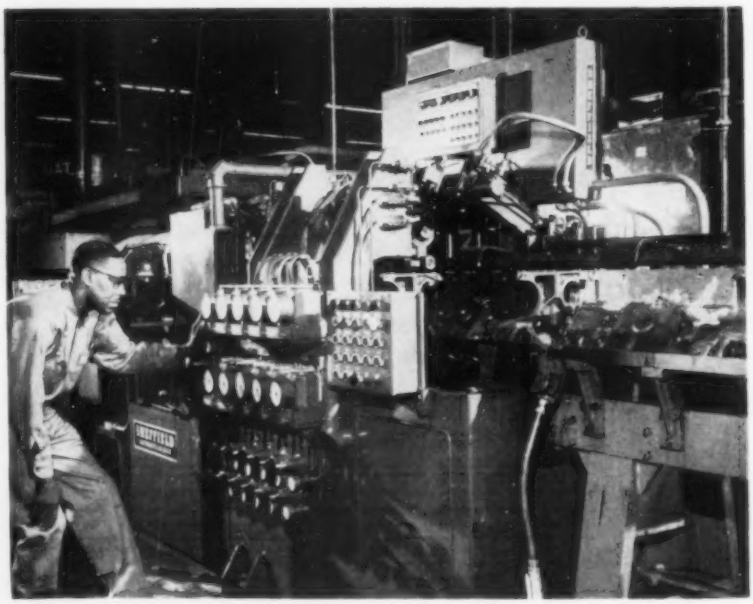
LIMA, OHIO—Integration of quality control with production on automated lines is a reality at Ford Motor Co's new plant here.

Some 1,700 gaging applications are located not only at separate checking stations but also on machining components along the line—particularly wherever a metal-cutting tool is subject to considerable wear, as with grinding wheels. Grinding of pins and main journals on crankshafts is regulated by a gage that rides continuously on the section being machined and reduces grinding speed, gradually as the pin or journal approaches the desired dimension. When the part is ground to specification, the gage automatically stops the operation.

According to Paul Caruso, Ford's superintendent of quality control here, the job of post-gaging is not only to eliminate rejects but also to identify the grade ranges of acceptable parts. Cams and cam bores in engine blocks may be rejected and eliminated from the line if they fall outside of acceptable limits. Those accepted will be graded then identified by color paint sprayed automatically near the bore before the part moves on to next operation. This permits selective assembly later—mating of same-grade parts is simplified by matching colors.

In the cylinder head, all valve guide holes are checked. This step either passes the part to the next operation or, if the part is outside required tolerances, a light is trained on it. When it shows white, the hole is undersize; if red, the part is over-size. In either case, the machine stops long enough for the operator to remove the part to the appropriate rework box, then resumes operation. Caruso says that color sprayers will be installed here.

Much checking is done through air spindles, quality of the part being a function of the flow of compressed air through the spindle during test.



In-process quality control . . .
is applied at Ford Motor Co's new Lima, Ohio engine plant. Here a completely automatic gage checks diameters in the engine block, rejecting those that are faulty.

Computers Permit New Statistical Analysis Concepts to Aid Design

SCHENECTADY, N. Y.—The use of statistical analysis in design is a big operation here at General Electric, and with the aid of computers the group is questioning the utility of many of the accepted assumptions and experimenting with new techniques. GE's aim: greater accuracy of the statistical process with a more simplified mathematical expression that will predict the performance of a complicated problem.

The statistical analysis group at GE's General Engineering Lab considers itself the oldest such group in industry. Formed in 1950, the activity has since expanded to some of the company's various divisions who have formed their own statistical analysis departments. The groups at the General Engineering Lab, besides doing advanced work, act in a consulting capacity to other divisions.

GE is presently applying statistical methods to purely computational problems that occur when large scale computers are used for product design. James Dolby, a member of the group says, "This has been done so effectively that we have been able to reduce the computational costs by 100 to 1 in some cases. We first used this method two years ago and in 1956 computer operation cost savings for one department were $50,000. The method has been considerably improved since then. Applied to reactor design, the method consisted of running a few experiments with various reactor components, using computer to get basic mathematical data. Then, using standard statistical methods, we can determine effect of certain design variables on performance.

ALLOWED TRIAL PERIOD

Actually, this consists of translating old statistical techniques to a computer operation. However, it did permit experimentation with new techniques. For example, the standard accepted procedures in statistical analysis can be questioned. While the normal distribution pattern can be used, other patterns can be investigated to see if we can get closer to the true physical condition. The exponential distribution pattern in life testing of a product, may need modification for realistic results. GE feels that built-in assumptions were made because the analysis procedures were easy to handle that way.

Now coming back into favor and getting increased attention by the GE group is the random balance experimentation procedure, which was used some time ago. This is directly opposite to the symmetrical selection technique, which, while made in an orderly fashion, is considered to have a biased selection pattern. Advantages of the random selection method: it is sequential in nature, permitting the selection of any number of points and is considered to be a more natural way of experimentation. The group adds that symmetrical method is always the most accurate, providing that you can make the most accurate assumptions to start with.

Another procedure being investigated: use of symmetrical patterns with the location of each point precisely defined.

RELIABILITY

Up to five years ago, the use of statistical analysis in estimating the reliability of components and products consisted only of the use of the simple exponential as the general distribution formula. GE now has a "product characterized" life test variables sampling plan which is not restricted to exponential. With the aid of high speed computers these PC plans have been tabulated for a wide range of application and are particularly applicable to product evaluation programs where decisions are to be made based on life data. The plan gives the designer the three basic life test parameters: how many should I test; how long should I test them; and how many failures will I tolerate to prove a certain reliability. But sufficient flexibility is built in so that the designer may juggle the test duration and sample size to accommodate his life test facilities. An advantage is that four separate schedules are available to cover four main classes of products—each with different failure

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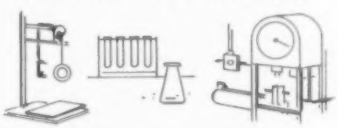

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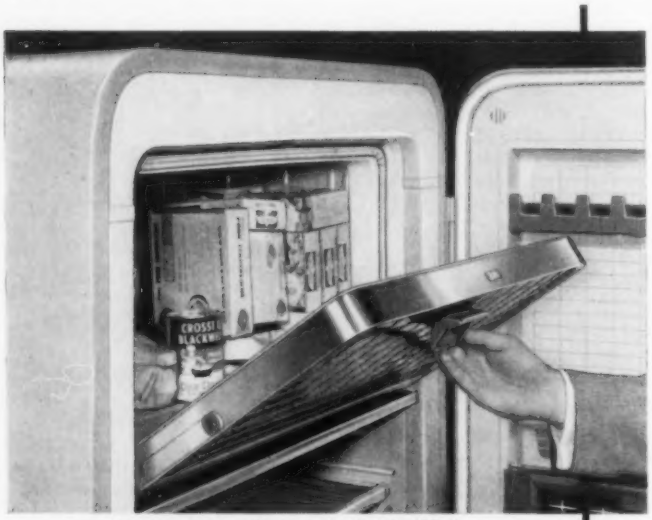
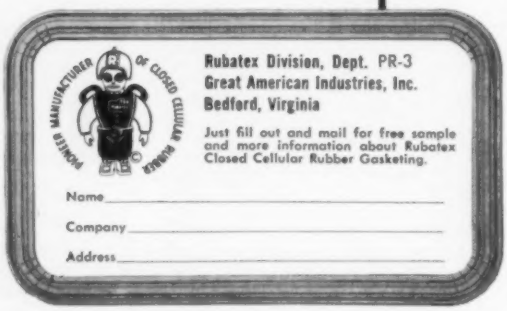
In addition to these important features, Kelvinator engineers also use Rubatex because it is convenient to work with and easy to apply in the assembly process.



Used as freezer door gasketing in '57 line — continued in Kelvinator '58 line

The principal application of RUBATEX in Kelvinator's combination refrigerator-freezer is a continuous gasket completely surrounding the freezer opening, on top, bottom and both sides.

This is a Closed Cellular Rubatex stock (No. G-251-C) especially developed in a light gray to give a fresh look and to blend beautifully with the metal door.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Company
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characteristics. GE says that this is the first sampling plan that allows for this differentiation.

Another concept—conditional failure density—is a particularly sensitive method that not only allows the designer to monitor life behavior, but also to determine the type of distribution his data represent. Conditional failure density is a measure of the probability that a survivor will fail in the next instant of time. The concept is not too different from survival or "hazard" curve used by actuarians, and could be interpreted as a plot of failure rate against time.

Million-lb-thrust Rocket Just More of the Same

Los Angeles—Building a liquid bipropellant rocket engine that will deliver a million-pound thrust presents no basic problems, according to Dave Aldrich, who will be program manager for a project recently awarded to North American Aviation's Rocketdyne Div. While the assignment of developing the required components to deliver more power at higher temperatures and pressures than encountered is a formidable one, Aldrich believes the big engine is feasible and no major scientific break-through will be needed.

The contract does not call for delivery of actual "hardware" to Wright Air Development Center, which awarded the contract. Rather, purpose of the work now under way is to demonstrate feasibility of the engine, decide on the fuels, and establish design specifications to serve as basis for production.

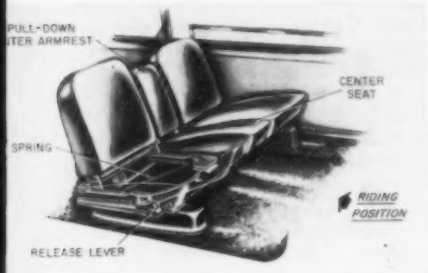
Present thinking, according to Aldrich, favors bi-propellants because of their higher performance. Selecting the best fuel will determine operating temperatures, pressures, fuel-flow rates and other conditions that govern design of tanks, pumps, controls, injector and combustion chamber. Some changes in production techniques are indicated by a simple scaling-up of existing designs—Aldrich foresees more automatic welding and furnace brazing—but previous test work done at Rocketdyne in developing engines for the Atlas, Thor, Jupiter, Redstone and other engines has yielded most of the information concerning materials capable of doing the job.

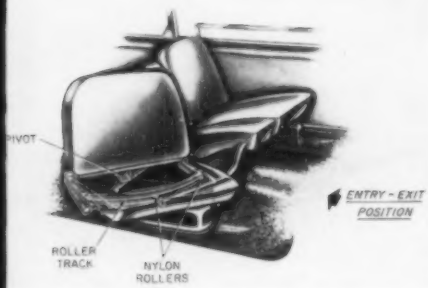
At present, to produce a 1-million-

lb thrust would require a cluster of six or more engines. Besides obvious unwieldiness of such an arrangement, the probability of malfunction is greatly increased because each engine operates an independent system and failure of any one would deflect the vehicle from its course.

Predicting that the final product will almost certainly be a conservative, "conventional" design, Aldrich says, "In a first-stage engine, the emphasis has to be on obtaining the highest possible reliability, which means the simplest possible design fabricated carefully and by proven methods. In two or three minutes, we're going to be burning a couple of tankcar-loads of fuel. If you have any tricky methods of controlling combustion or getting more predictable thrust, you save them for the final stage where you're aiming the vehicle and have to know exactly what you're doing—and where the quantities that have to be controlled are more reasonable."

Swivel chairs are switching . . . from Chrysler offices to Chrysler products. Designed to make it easier for passengers to get in and out of cars, the new seat is equipped with a pivot midway along the back of the seat that allows the seat to swing through 40 deg without interfering with the steering wheel. It turns on a simple track. Two nylon rollers, housed on the roller track, plus a bolt at the pivot point, anchor the seat. Swivel front seats will be optional equipment on all five lines of Chrysler cars in 1959.





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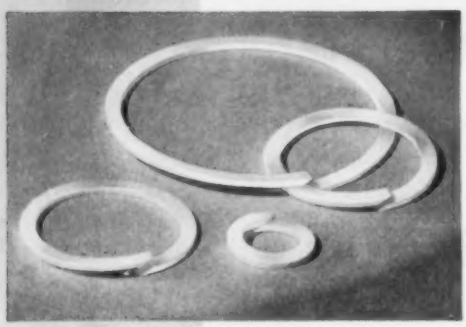

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Measure Tiny Spheres by Cross-guide Coupler

Los Angeles—Though hardly larger than specks of dust, magnetic iron-ceramic spheres can now be measured for microwave properties by a rapid method developed by a Lockheed Missile Systems Div. research scientist.

Experimental techniques in measuring ferrite line-widths (gaging the microwave qualities of the particular material) with a cross-guide coupler were outlined by Lockheed's Donald C. Stinson at Western Electric Show and Convention (WESCON) here.

Ferrites, composed of iron oxide and other ingredients, are used in radar, telemetering, and other electronic applications because of their excellent microwave qualities. Lockheed makes and grinds them. With Stinson's method, ferrites can be measured in five minutes rather than the several hours required with conventional equipment that is far more costly and complex.

The samples tested are often so small that only a magnet can pick them up. In operational electronic devices, however, ferrites may be in the form of rods or plates several inches long.

In making measurements, Stinson's 6-by-9-in. cross-shaped coupler—with the sample in a center hole—is connected with a microwave power source and other power-measuring apparatus.

Prop-jet executive transport . . . makes its maiden test flight for Grumman Aircraft Engineering Corp. of Bethpage, N.Y. "Fail-safe" structural design includes a wing box beam integral fuel tank made up of four integrally-stiffened machined planks on upper and lower covers. With this arrangement, any single element can fail without catastrophic wing failure. The 19-20 passenger Gulfstream is designed for 25-yr structural fatigue life. Powered by a Rolls Royce Dart engine, the craft has maximum cruise speed of 370 mph at 25,000 ft and a range of 2200 mi—plus a reserve of 200 mi and 45 min fuel.

X-ray photo shows a typical use of Du Pont TEFLON TFE resins as seals in hydraulic power cylinder

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Rolled Beryllium Sheets Tested for Air Force

DAYTON, OHIO — Rolled beryllium sheets are being shipped out of the Air Materiel Command to a number of airframe and missiles manufacturers for evaluation.

For a long time beryllium "couldn't be rolled" into sheets. The ones now being shipped are the result of a development program carried out by Brush Beryllium under Air Force auspices. The first sheets successfully rolled were 12 to 18 in. wide by 60 in. long, in thicknesses of 20, 40, and 60 thousandths of an inch.

Widths of 18 to 24 in. have also been rolled in the same thicknesses, the next goal being sheets between 24 and 30 in. wide. The program also calls for developing techniques that will produce sizes between 36 and 42 in. wide in lengths between 72 and 96 in. Thicknesses will be between 20 and 80 thousandths. Some sheets wider than 32 in. and up to 72 in. have already been rolled.

Control of pressure on the rolls and temperature of the beryllium are critical to obtain highest strength in the resulting sheet. These have ultimate tensile strength between 80,000 and 104,000 psi, yield strength between 57,000 and 80,000 psi, longitudinal elongation of 12-13% and transverse elongation of 10-12%.

Material used is "nuclear grade" beryllium, containing about 1.5% beryllium oxide. Because of the metal's high toxicity, the beryllium is sandwiched between two slabs of mild steel and welded all around. Then the whole sandwich is rolled, and the steel is peeled off to obtain the beryllium sheet.

Develop Flame-retardant Polyethylene Compound

NEW YORK — New flame-retardant compounds of high density polyethylene in a variety of colors has been reported developed by W. R. Grace & Co. Spokesmen for the latter said first applications of the compounds will be housings for electrical components of television tubes, and cylinder heads for tanks containing nitrogen, oxygen and acetylene. However, the development also opens the way to a wide range of new or improved products using polyethylene.

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Contact force of 4 ounces per contact on 50 "G" models and 2 ounces per contact on 30 "G" models of "Diamond H" Series R and Series S miniature, hermetically sealed, aircraft type relays is one of the most important factors in their proven high reliability.

Though absolute reliability of any similar device is impossible to guarantee—a bitter fact of life recognized by all electronic engineers—close approach to this goal by the relays manufactured by The Hart Manufacturing Company is the basic reason they are found today on many of this country's headline-making missiles.

In addition to contact force far beyond that found on other relays, "Diamond H" relays have greater contact cleanliness. Self-contamination is virtually eliminated by a completely inorganic switch mechanism, as well as use of coil materials which will not dust, flake or out-gas.

Finally, the high degree of reliability that is designed into these relays is maintained in their manufacture by high quality workmanship and a stringent inspection policy at every stage.

In addition to missiles, and their ground control systems, Series R and S relays are designed for use in jet engine controls, computers, fire control, radar and similar critical applications.

4PDT units, they offer an extremely broad range of performance characteristics, including temperature ranges from —65° C. to 125° and 200° C.; ratings to 10 A., 120 V., A. C., and 26½ V., D. C., with special ratings to 400 ma. at 350 V., D. C., or down to millivolts and milliamperes. Dry and wet circuits may be safely inter-mixed.

For more information, write today for Bulletins R250 and S260. For quick facts about "Diamond H" switches, thermostats and other devices, ask also for a copy of the "Diamond H" Check List of Reliable Controls.

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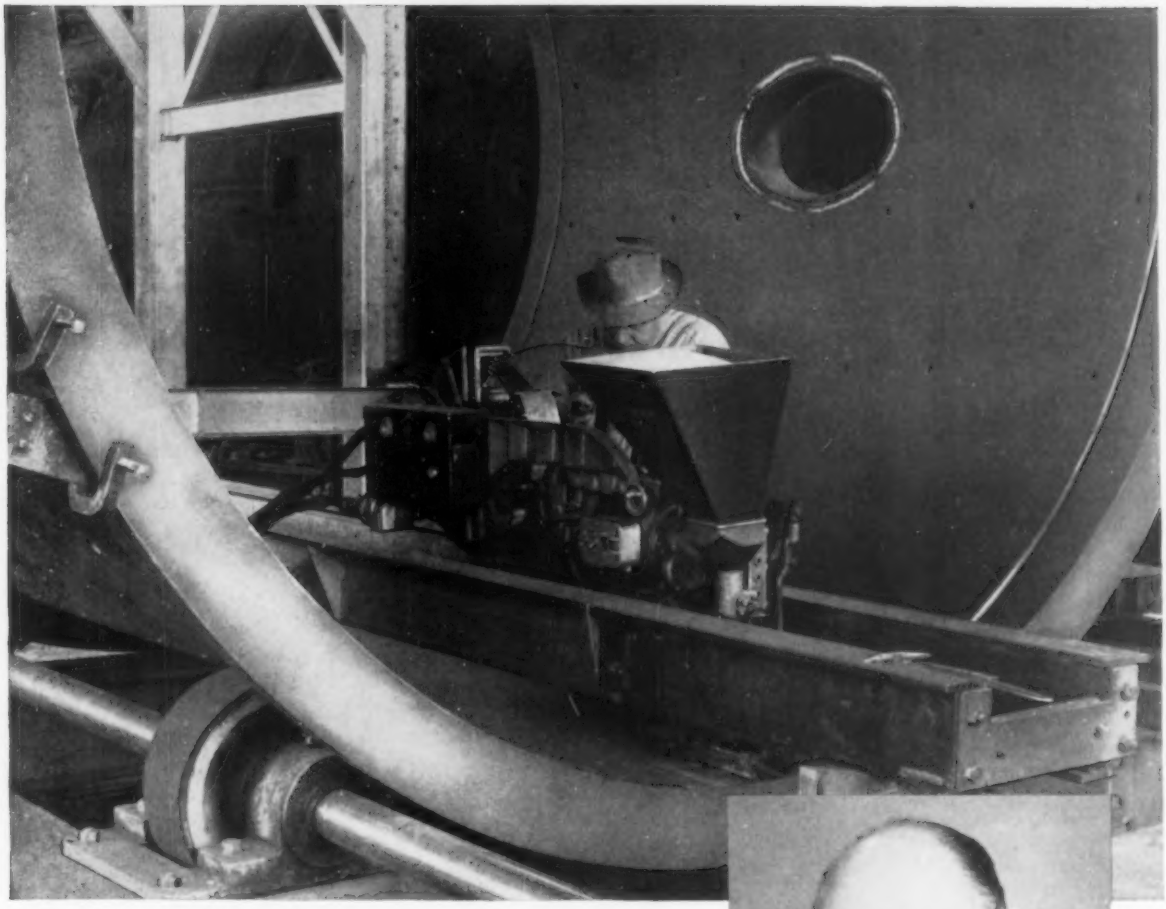

Many of Mine and Smelter's Marcy grinding mills are equipped with Standard Steel flange rings, shown above. No flange ring replacements have ever been required. Some of these mills have been operating 24 hours a day for more than 15 years.

"'Dependability' is the keyword in our very fine relationship with Standard Steel"

We at Standard are happy indeed that Mine & Smelter Supply Co.'s chief engineer, J. R. Grout, appreciates the efforts we have gone to over the years to combine dependable service with our know-how and quality standards.

We consider it our responsibility to help maintain the world-wide reputation for quality mining and industrial equipment which Mine & Smelter Co.'s Marcy Mill Division enjoys by providing this customer with the same fine service it renders, in turn, to *its* customers.

Won't you discuss your needs for weldless rings, flanges, forgings and castings with us. You will appreciate our personalized service. Write Dept. 4-J.

"Standard Steel for many years has been supplying our company with shell flange rings, as well as riding and roller tires for use on our Marcy Grinding Mills and other rotary-type equipment. Their product quality and cooperation have helped make it possible for us to serve our customers promptly—our company policy. I believe the word 'dependability' is the keyword in our very fine relationship with Standard Steel," says Joseph R. Grout, chief engineer, Marcy Mill Division, Mine & Smelter Supply Co.

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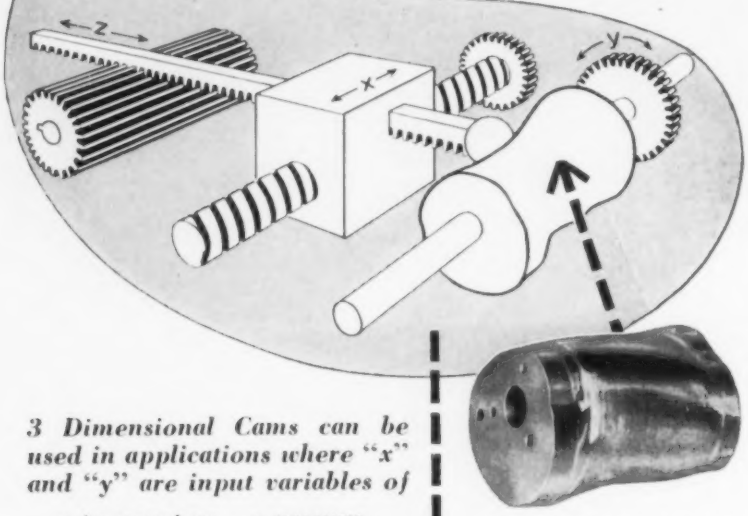


3 Dimensional Cams can be used in applications where "x" and "y" are input variables of

- temperature
- pressure
- R.P.M.
- liquid flow
- speed
- altitude

or any of thousands of other forces or motions.

"z" is the instantaneous resultant or readout of the two input variables. $z = f(x,y)$.

Some advantages—

- withstand severe environmental extremes
- fidelity of readout
- smaller control size
- lighter control weight
- dependability

NOW AVAILABLE . . . the latest and most complete brochure on 2 and 3 dimensional cam control. Fully illustrated and diagrammed—design, development, application information. Send for your copy today!

THE PARKER-HARTFORD CORPORATION
CAM DIVISION
FRANKLIN AVENUE • HARTFORD, CONNECTICUT

by Parker

Bits and Pieces

THERMISTORS THAT FUNCTION . . . . continuously at 1200F are commercially available from Fenwal Electronics, Inc., Framingham, Mass. Offered as beads with attached leads and without glass coatings, the thermistors have resistance of 250,000 ohms at 25 C, 0.7 dissipation constant and 2 sec time constant.

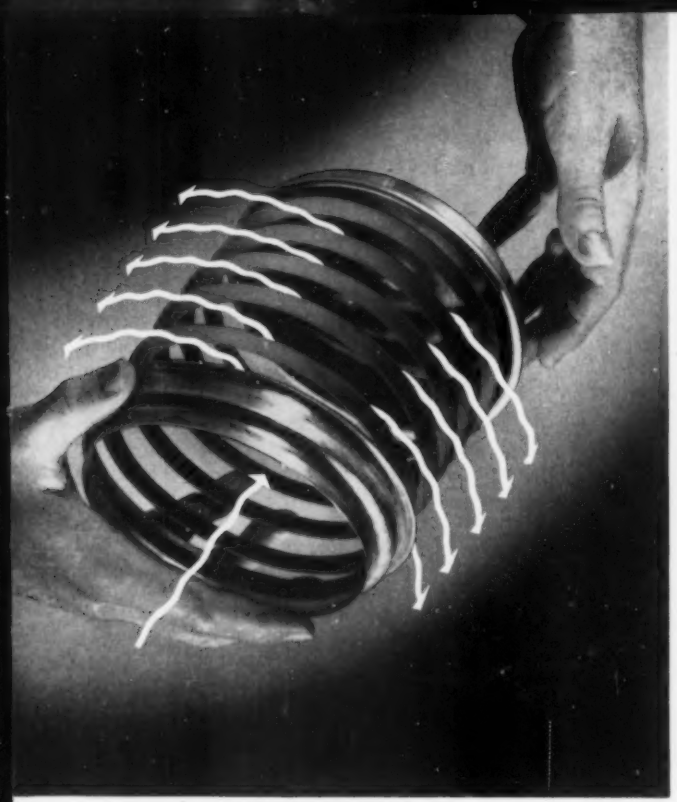
THE VACUUM METALLURGY LAB . . . . of F. J. Stokes Corp., Philadelphia, is being thrown open to outsiders for limited scale research projects. Stokes facilities include an induction heated vacuum melting furnace with crucible capacity of 17 lb and capable of handling ingots up to 15 in. high and 10 in. dia wall. Lab services will be available at nominal cost.

A METAL PROTECTIVE PAINT . . . . that does not contain pigments or resins is being manufactured by Mac Cleaster Chemical Co., London. With a zinc silicate base, the new paint will protect metals from atmospheric, seawater, freshwater, electrolytic, galvanic, and carbon corrosion, the company says. It resists temperature to 1060 F.

SPECULATION THAT RUSSIA . . . . will launch a satellite to relay TV transmissions has been sparked by an article in the Scientific magazine, *Znanie Sila* (Knowledge is Strength). The magazine account says such a satellite could insure steady reception from the 82nd parallel north to the 82nd parallel south. It would have to rotate at a height of 22,350 mi where it would move at the same angular speed as the earth; hence, in effect the satellite would remain steady.

A TWIN-ELEMENT OIL FILTER . . . . whose cylindrical housing encloses wire mesh filters in the upper half and magnetic plates in the lower half has been developed by VEB Industriearmaturen und Apparatebau of Leipzig, East Germany. Oil forced into the lower half is cleared of ferrous metal particles by the magnetic plates and then is cleansed of other impurities by the mesh in the top compartment. Elements can be used separately or simultaneously.

CIRCLE 69 READER SERVICE CARD
CIRCLE 70 READER SERVICE CARD→



How neoprene makes improved air valve design practical

A simple helical spring, covered with neoprene tubing, replaced a complicated metal sleeve valve in a ventilation unit made by Connor Engineering Corporation. It governs the flow of air into the mixing chamber of Connor's air diffuser.

One end of the spring fits into the air duct and the other end is capped. The capped end is mechanically linked to air temperature and volume controls. Air flows through the extended spring; when the control mechanism compresses the spring, air flow is throttled or shut off.

Many resilient materials might have been used for this novel valve — but with Du Pont neoprene, the designers expect the tubing to last as long as the ventilating system. Neoprene's excellent aging properties mean that the tubing will remain resilient and assure a tight seal on close-off.

Neoprene's properties are stimulating other new design ideas. Resistance to oil, weather, heat, many chemicals and flex fatigue are important in many products.

For more information, send the coupon. We'll also be glad to tell you about two new Du Pont elastomers, HYPALON® and VITON.

ELASTOMERS IN ACTION HYPALON® • NEOPRENE VITON TRADEMARKS

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Better Things for Better Living
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☐ I am particularly interested in _____

☐ Send me a free copy of *The Du Pont Elastomers* (a review of properties of neoprene and HYPALON).

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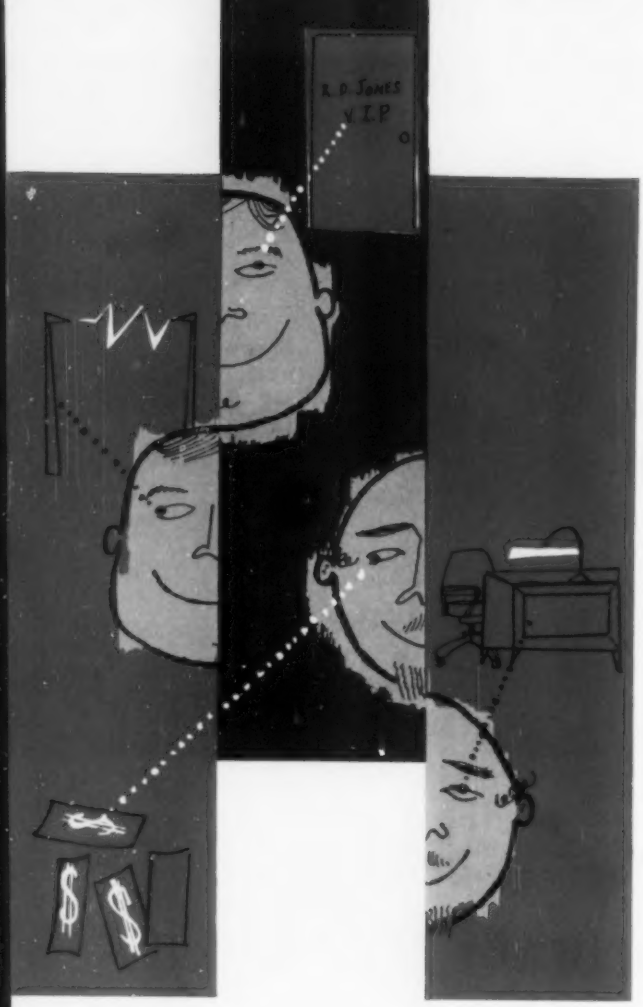
City _____ State _____



GEORGE A. PETERS
STANLEY MICHELSON
Consultants, Psychological Research Associates, Inc., Encino, Calif.

RESEARCH MANAGEMENT

. . . a problem in personalities

**First, understand the man—
then encourage him with what *he* values most.**

■ Some very basic differences in individual researchers have apparently still not been recognized by management. And until proper incentives are offered to the research personality, industry will continue to lose the cream of research creativity to the tug of job dissatisfaction.

Researchers may be classified in one of two fundamental types. These two groups are arbitrarily labeled the "logical scientists" and the "research synthesizers."

The logical scientists adhere very closely to formal scientific methodology and established fact. They work in an orderly, sequential, and highly logical manner within bounds of a comparatively narrow specialization. They seek to establish validity of new concepts, to elaborate and refine theories, and they feel most at ease with accuracy and certainty.

Such men prefer authoritarian presentation of organized knowledge, polished generalizations, and established scientific laws. They have an overdeveloped respect for the "scientific method," and this may foster a rather uncompromising professional disdain for all unsupported speculation or tenuous logic. When operating on a less professional level, they are often completely restricted to standard procedures. Fearful of breaking away from the exact printed word, they sometimes seem to seek instruction at every step, and to appear lacking in imagination and capacity to accept additional responsibility.

Research synthesizers are typically imaginative, creative, and willing to take chances. They have many and varied interests, sometimes seem more adventurous then scientific, and are willing to use unsophisticated methods to explore speculative guesses and hunches. Often, they seem unable to spend very much time in any one area of endeavor. But they are willing to accept the high risks associated with maximum possible gain rather than pick the road of minimum risk (which usually offers minimum gain).

The research synthesizer may be a likely candidate for research management. By inclination and experience, he has the broader perspective and

understanding necessary to grasp the over-all objectives. The logical scientist who has supervisory responsibility may turn out excellent in administrative detail, but so fearful, insecure, and constrictive in establishing the parameters of scientific investigation that it may have little chance for success.

The expansive research synthesizer does need the checks and balances of the more somber, conservative and self-assessing logical scientist. There should be an adequate sprinkling of both in the research organization. But promotion to supervisory responsibility should not be in terms of promotion for greater pay, promotion for greater status, or even promotion for scientific accomplishment. It must be in terms of leadership capability and managerial skills—or a misplaced research director will quickly squelch the fires of scientific creativity.

For just as the logical scientist protects himself scientifically, so does he tend to isolate himself organizationally. I can think of several cases where an individual similar to our logical scientist stereotype was given prime responsibility and he developed a multiplying system of supervision, administration, review, coordination, appraisal, and advice which markedly outweighed and outnumbered the producing scientists. Flexibility, communication, and assumption of individual responsibility for decision quickly disappeared.

Only the research synthesizer has the courage to accept what can be called *spontaneous research*. This is the research for which no money has been allocated, no research facilities provided, no time allotted, no permission given, and it is done by individuals whose job duties may not even include such research activities. Even when such research is successful, an unpermissive, fearful supervisory atmosphere may deny the company any potential benefit. A supervisor will feel that it is better to keep such things hidden than to have to explain how and why it was done in the first place.

Status determiners

To encourage spontaneous research, or indeed any creative work, requires thoughtful use of status determiners. This term means any sign or evidence of the individual's value to the company. It is, in one sense, recognition of the individual's personal worth.

Typical status determiners include job titles, salary, office location and furnishings, the kind of company identification and security badges issued, the location of individual parking spaces and the kind of automobile stickers or plates received, the use of separate dining facilities and washrooms, the kind of correspondence which may be signed, and the surprisingly important use (or non-use) of timeclocks.

We must recognize that these are real and important sources of conflict in the industrial situation. This is particularly true when new engineers find themselves assigned to that desk located in the fifth row and eighth column of a large windowless barn profusely hung with lighting spaghetti and with an ambient noise level just below the level of physiological damage. Perhaps this is too severe a description of some engineering facilities but all too frequently work situations involve crowding, inflexible regulations, highly simplified routine procedures, protective compartmentalization, and utter depersonalization.

Now, if the research scientist desires some form of personal recognition or status, and if this serves the needs of the company, we should use the maximum possible number of status determining devices as work incentives. They should be potentially applicable to each and every individual within the company rather than be heaped upon a few deserving souls. We should also remember that different individuals have different values or standards. A reward to one means little to another. Some people just don't want supervisory responsibility. Others may regard additional pay as less desirable than some other change in their working environment.

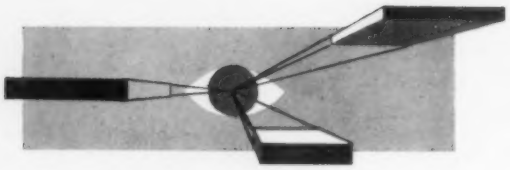
Pay and promotions are generally tied closely together. While merit promotions are a highly desirable incentive to significant work achievement, they are a relatively long-term form of reward, dependent upon many factors, of which merit is only one. The concept of merit promotion also runs counter to the general psychological principle that rewards, to be effective, must be (1) immediate (given as quickly as possible following significant work achievement), (2) they must be consistent (fair in their application to each and every worker), and (3) they must be appropriate (in regard to the actual value of the achievement). For these reasons, merit promotions are probably less important than other, more flexible, incentives and status determiners.

For example, one possibility is to separate pay from promotion. A really effective bonus payment plan, fraught as it is with the sticky problems of how it may be effectively administered and implemented, is a promising method.

An important status determiner is the extent of personal responsibility in regard to future research. One of the most frequent complaints by research scientists is the lack of sufficient responsibility and freedom of action in approach to scientific problems. A large proportion of industrial research scientists feel they have too little professional challenge on their current work tasks.

Another important status determiner, which does not involve pay and promotion, is in the matter of publicity on a local, corporate, industry-wide, or professional level. Good publicity tends to enhance the research worker's feeling that he has made an important contribution both to science and to the company. Other employes also see this as evidence of research accomplishment and thus all employes increase their sense of pride in their affiliation with the company and its products.

A logical scientist, for example, who should be rewarded for his outstanding job performance might be given a promotion to greater supervisory responsibility so that he can get a salary increase. But the company may be better served and the scientist be far happier, if the reward were a bigger desk, some additional laboratory facilities, some encouragement and help in professional publication, a chance to work overtime on a special research project, or some badly needed support personnel. ■



POINTS

THE QUESTION: **Paid Leave for Advanced Study?**

S. F. LEAHY
VP and Manager, Employe Relations
Detroit Edison Co

"Unless positive steps are taken . . .

to broaden the training and experience of executives, few will be as well qualified as they should to direct modern organizations. The key figure in developing the manager is the individual to whom he reports. The latter sets a climate which promotes personal development and he supplements this with careful planning of opportunities for growth. Certainly self-development is still the heart of management education and it thrives best in an atmosphere of confidence and support. Nevertheless a program of individual guidance can be followed to insure that development is well rounded and in directions needed by the organization.

"One resource for executive development is found in the programs for advanced study offered by universities and management consultants. These have a number of values for broadening the manager and taking him out of his specialized area in a particular company. The experience frequently gives him time and background for analyzing his ideas and methods with new understanding and from fresh points of view. To measure this effect is not easy. Its working can be observed, however, in many cases by the changed attitude or wider perspective with which problems are later approached. Undoubtedly the results will vary with the individual and in some cases might even be negative.

"Unsatisfactory results are most apt to occur when a blanket decision is made to assign executives to courses without regard for individual needs. The risk can be minimized by careful study of the available offerings in relation to the individual's background and needs."

"Self-development should be the key . . .

to the engineer's professional advancement. Each engineer is an individual and should be given every encouragement to select and finance his own professional advancement. The industrial emphasis should be one which assists and motivates this development rather than to fully provide for it in a welfare sense.

"After a period of industrial employment, changing attitudes and objectives often show the need for advanced study and occasionally lead to industrially financed leaves of absence for professional development. Most of the industrial aid has been to provide partial support, including refund of tuition upon satisfactory completion of advanced study primarily at the Master's level. Normal compensation for work performed in the company, along with fellowship aid during periods of study, has been the increasing pattern in industry during recent years. This support procedure should not be encouraged to the point where it replaces our normal university educational processes. Industrial support to engineering graduate schools in the form of fellowship aid is important and should not be curtailed in favor of paid leave."

JOHN K. WOLFE
Manager—Advanced Degree Personnel
General Electric Co

OF VIEW

CARL H. HAGEMAN
VP, Industrial Relations
Union Carbide Corp

"Occasionally, yes . . .

If we should request an employe to pursue a specific course of advanced study, we would, of course, foot the bill. Generally, however, we believe that a measure of self-reliance ought to accompany an individual's desire for continued academic study. Union Carbide provides financial assistance to employes who complete qualified courses of study, outside of regular working hours, while still employed. This assistance takes the form of a reimbursement of 50% of the cost of tuition, laboratory fees, necessary supplies, and required textbooks for the course.

"Additionally, we grant leaves of absence of up to a year in length to permit employes to complete residence or other special requirements for a Bachelor's or advanced degree."

DR. HARPER Q. NORTH
President
Pacific Semiconductors Inc
Culver City, Calif.

"The benefits to be derived . . .

from a leave-with-pay to further education depends upon the individual and type of education, and the company for which he works. Often such education is of a specific nature and directly applicable to the work done by the employe; in such cases the company may decide on a purely business basis whether or not the performance of the employe will be sufficiently improved by the education to warrant the expenditure. Financing a more general type of education with pay during a leave can usually be justified only by the larger companies considering it as a donation in recognition of past service, a means of promoting improved employe morale and loyalty, or even as a contribution to the community.

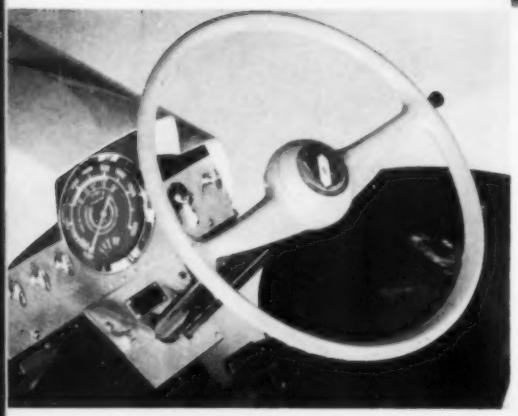
"The policy of granting leave with pay for further education is, of course, a strong attraction to young graduates who wish to return to school for advanced degrees but are financially unable to do so."

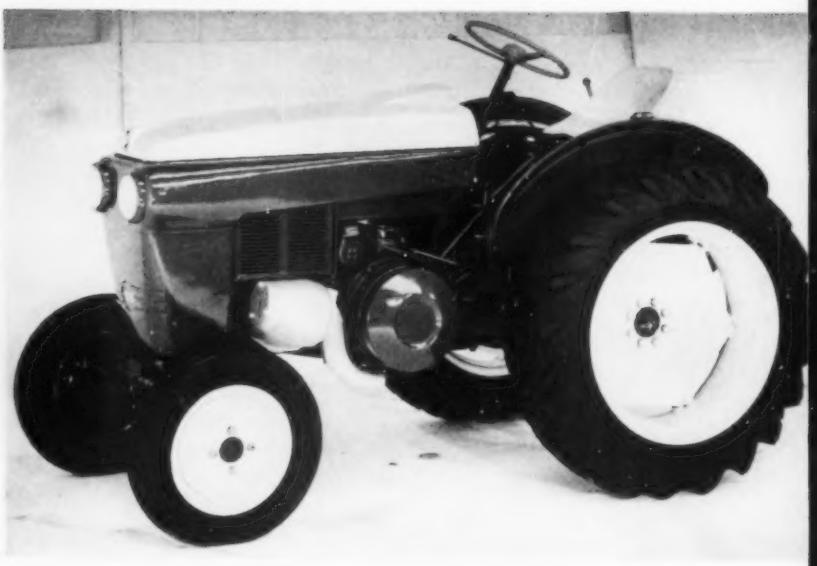
"This is one concrete way . . .

in which industry can help meet today's need for more and better engineers. All too often industry is content to sit back and wait for the government to start action. In a private enterprise system such as ours, it should really be the duty of industry to take the initiative. Not only because it will help raise the nation's scientific level, but also because it is a profitable investment for future returns.

"It is a good idea for a graduate to work in his chosen field for a while before determining his advanced study field. What I consider a good plan is for the company to have an organized program for the employment of students during the summer and also on a part-time basis. In this way, the student obtains some working knowledge of various phases of his field, and also learns about the company from actual experience. Likewise, the company has an opportunity to observe the student and evaluate his qualifications, both from the standpoint of the company and the best interests of the student. Such a plan eliminates the need of any delay in starting the advanced study."

PAUL M. CHRISTENSEN
Coordinator of Engineering
Federal Pacific Electric Co
Newark, N. J.



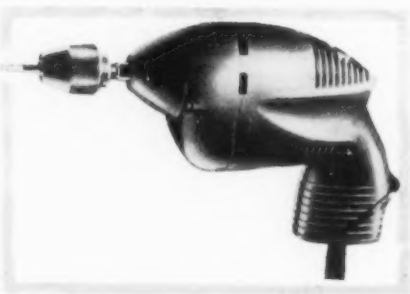


Re-designed gas diesel tractor has radically re-grouped and cleaned up instruments and controls (former arrangements above, right) two plastic hoods (for light and major maintenance) and horizontally placed motor. By Compagnie de L'Esthetique Industrielle (sub Raymond Loewy Associates) for Societe Francaise Vierzon.

Anchor is result of a student design project in France's only school for industrial design.

Motion Picture Projector with folding reel arms, by Bureau d'Etudes Technes for Pathe.

Hand Drill by Bureau d'Etudes Technes.



in appearance design...

...IN FRANCE

by **JACQUES VIENOT**, Chairman Syndicat des Stylistes Industrielles et Ingenieurs-Estheticians; and President, Bureau d'Etudes Technes, Paris

■ Good design is an old story . . . Leonardo da Vinci once promised a patron "guns as terrible as they shall be beautiful in shape."

Today, however, in France, the US and some other countries, industrial design is methodically applied to increase sales. This represents danger, especially for industrial design organizations (including my own) which each year give a "new look" to products, although no technical improvement or added usefulness warrants such changes. Result is likely to be jaded consumers, unimpressed by these "new" products. Future advertising may, of necessity, have to announce, "This product guaranteed against change!"

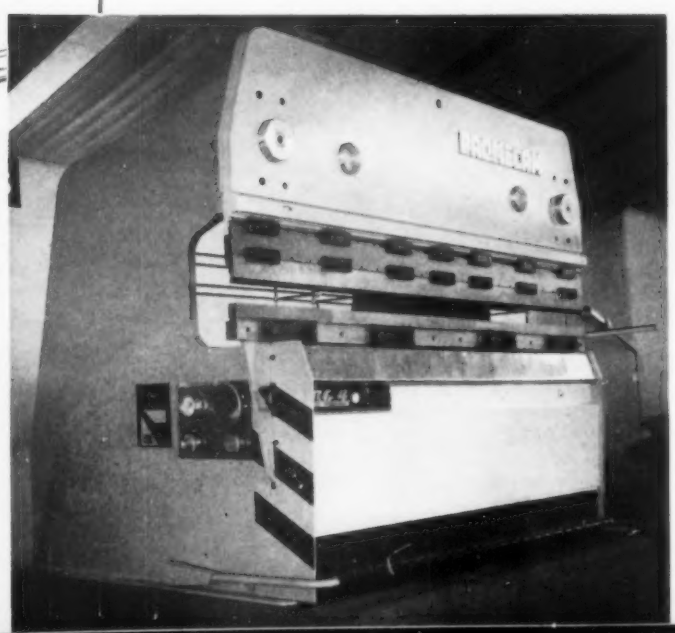
There is a possible alternative to this. Designers must be allowed to strive for the harmony between function, performance and appearance we know is possible. There are already guiding principles for a theory of, shall we say, "useful beauty."

Important contributions to such a study can be expected from French industrial designers and our unknown though gifted engineers and others working on appearance-design problems. These Frenchmen draw on a tradition of esthetics, engineering and craftsmanship that has produced famous cathedrals, chateaus, painting, furniture, jewelry and firearms.

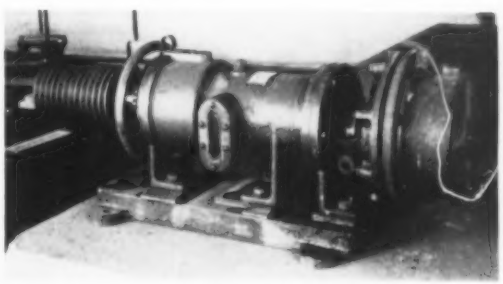
Our principal designers belong to the Professional Association of Industrial Designers.

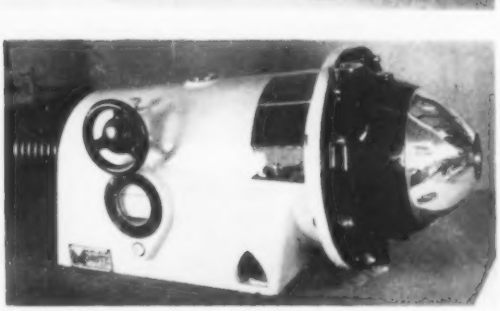
Acceptance of French design specialists has been accelerating because French manufacturers are realizing the role of good design in competition for sales and, even more, because of wide public demand for better looking, more functional products. With the projected European common market about to become a part of French economic reality, it is fortunate that much of the work of our designers compares favorably with that of their colleagues. ■

Television set's tube swivels. By Philippe Charbonneaux for Teleavia.



Before (left) **and after** (below) views indicate how Viaud Associates brought elements of Promecam hydraulic press into a more integrated whole.

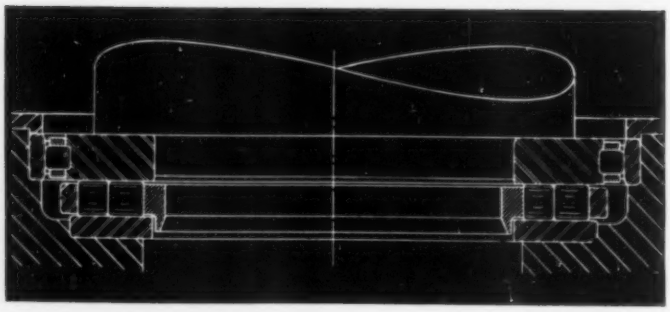




Ore crusher is now enclosed in housing, designed by Viaud Associates for Moritz.

COVER DESIGN includes television set shown above, motorized crane for Salev and hand drill for Micox by Bureau d'Etudes Technes, together with student design for weighing scale.

SIGNIFICANT COMPONENTS • MATERIALS • PROCESSES



Thrust-radial bearing . . .

is for applications where both types of loads must be carried in restricted space. Unit consists of two roller assemblies, with flanged inner race of radial section also serving as revolving plate of thrust section. Outer race of radial bearing is stationary with respect to inner race and separable to facilitate assembly. Radial portion of bearing is on shaft. Standard bearing of 6⅜-in. OD and 3½-in. bore at 100 rpm has radial capacity of 3150 lb and thrust capacity of 24,600 lb; at 1750 rpm, radial capacity is 1340 lb and thrust capacity, 9500 lb. Bearings are all custom-produced. Delivery, 60 to 120 days. **Rollway Bearing Co., Dept X-2561, 541 Seymour St, Syracuse NY.**

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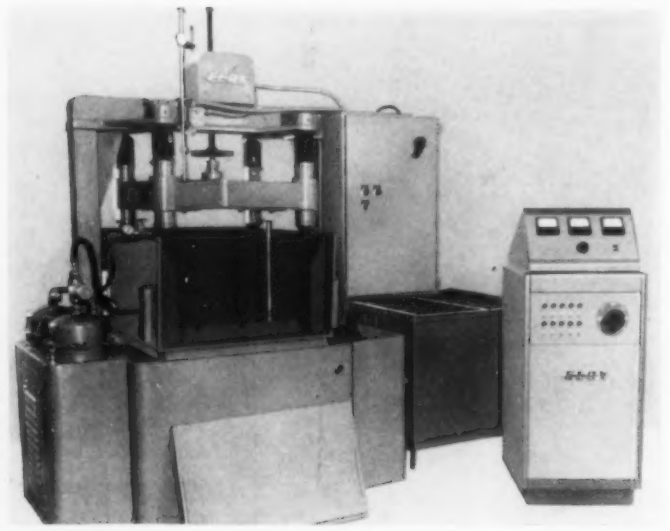

Electrochemical machining . . .

process permits high metal-removal rates at low cost per cu in. of metal. Electrode, made of any conductive material, and workpiece are submerged in saline solution. Metal is removed by electrochemical action controlled by sensitive servofeed system that automatically advances electrode into workpiece as machine progresses. Metal-removal rate, at 500 to 50,000 amp. range from 30 cu in./hr to 300 cu in./hr, depending on amperage employed and electrode surface area. 500, 1000 and 5000-amp units are available for 4-mo delivery. Prices for these machines range from about $10,000 to $30,000 each. **Elox Corp of Mich, 1830 N Stephenson Hwy, Royal Oak, Mich.**

Circle 12, Reader Service Card

Epoxy paste cures underwater . . .

and may be trowelled or squeegeed into position. Hardening takes place in several hours. Develops good adhesion to clay, stone, metals and other surfaces. Available from stock. $108.75 in 5-gal units with hardener. **Furane Plastics, Inc, 4516 Brazil St, Los Angeles 39.**

Circle 13, Reader Service Card

Silicon temperature probe . . .

senses changes by measuring resistance in a mass and recording this resistance as a temperature indication. Sensing device is encased in glass package 0.078 x 0.500 in. long. Senses temperatures from that of sub-zero liquid rocket fuel to 328 F. Probe is made from a silicon crystal with a monocrystalline structure, eliminating hysteresis problems usually associated with sensing devices subjected to severe temperature changes. Available in standard resistances of 100, 500 and 1000 ohm in prototype quantities immediately at $22 each. Matched pairs and other resistance ratings are available. **Texas Instruments, Inc, Semiconductor-Components Div, PO Box 312, Dallas.**

Circle 14, Reader Service Card

Epoxy adhesive for preforms . . .

can be molded under moderate pressure, after slight heating. After cooling, preforms are usable as quick-setting adhesive for applications where they can simplify operation. Complete cure of preform occurs at temperatures from 350 to 500 F. Priced at $10.25 per 5-16 gal. Available, 3 to 5 days. **Emerson & Cuming, Inc, 869 Washington St, Canton, Mass.**

Circle 15, Reader Service Card

Nonmagnetic bearing . . .

has linen-reinforced phenolic races and uses Pyrex balls. According to the type of phenolic used, it can be run immersed in water, acids, oils and environments that steel balls will not allow. Custom-made to specifications. **Halax Corp, 17470 Shelborne Way, Los Gatos, Calif.**

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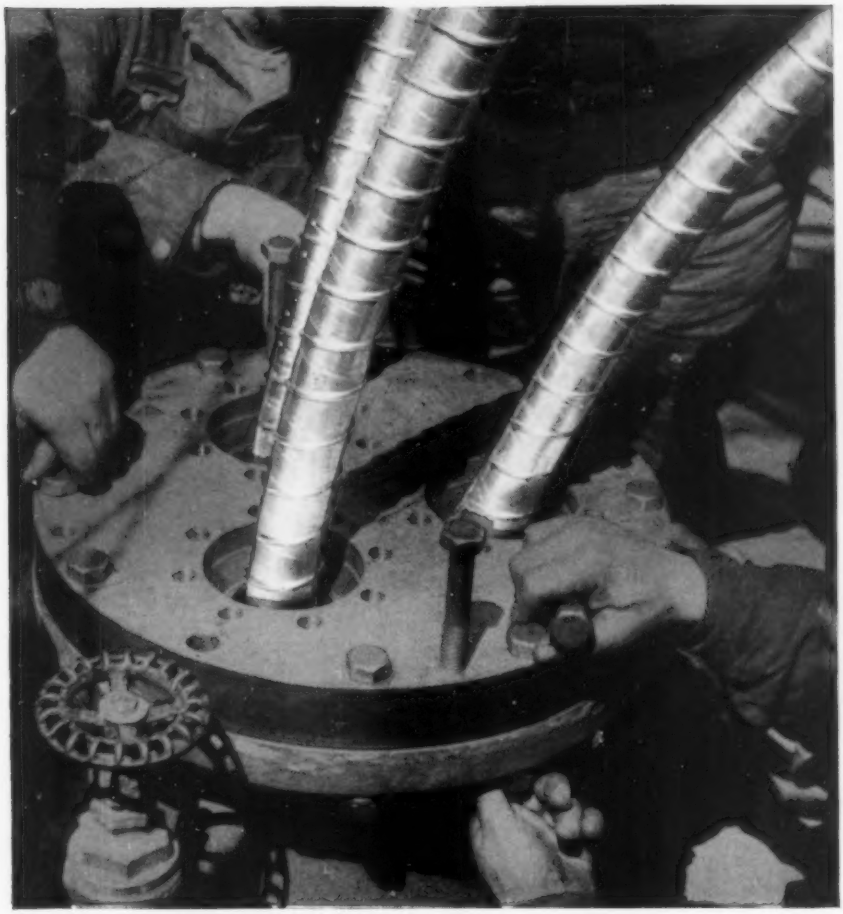
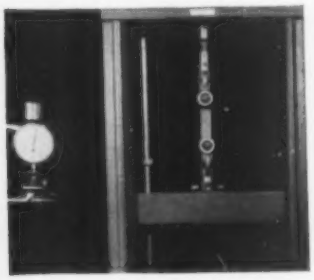
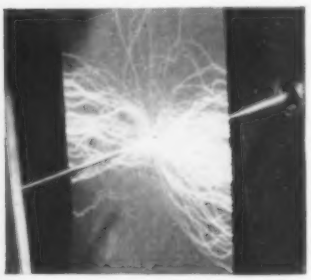


PROPERTIES OF "MYLAR"

"Mylar" offers a unique combination of properties that may help you improve performance and lower costs of *your* product. Here are two of the many important properties for evaluation.



HIGH TENSILE STRENGTH. "Mylar" is strong and durable. Instron Tester shows an average strength of 20,000 psi. It's dimensionally stable . . . resists moisture.



HIGH DIELECTRIC STRENGTH. Average of 4,000 volts per mil . . . average power factor of 0.003 to 60 cycles.

General Cable reports . . .

New shielding assembly with Du Pont Mylar® limits oil drainage . . . restricts moisture pickup

PROBLEM: To provide an outer shielding assembly on General Cable's high-voltage, high-pressure pipe-type cable. The assembly had to resist oil drainage during shipment and storage as well as restrict surface-moisture pickup during installation.

SOLUTION: After extensive tests on various materials, General Cable Corporation adopted two new tapes for the outer shielding assembly . . . one tape was "Mylar"* polyester film; and the other, a "Mylar"/foil lamination.

RESULTS: General Cable tests showed that "Mylar" provided a tight, yet flexible, assembly and effectively reduced oil drainage. The high tensile strength and other excellent physical properties of "Mylar" permit its application to the cable under high tension. "Mylar" restricts surface-moisture pickup when the cable is exposed to air during installation. "Mylar" is not affected by the insulating oils . . . has no plasticizer . . . will not contaminate other materials.

How can "Mylar" help you? Whether you manufacture heavy-duty cable or tiny capacitors, it will pay you to evaluate the combination of properties found only in "Mylar." And when figured on an area basis, this tough, thin polyester film will often *cost less* than your present insulating material. For more detailed information, send in coupon.

DU PONT

BETTER THINGS FOR BETTER LIVING
. . . THROUGH CHEMISTRY

DU PONT **MYLAR**® POLYESTER FILM

*"MYLAR" is Du Pont's registered trademark for its brand of polyester film.

E. I. du Pont de Nemours & Co. (Inc.)
Film Dept., Room P-9, Nemours Bldg., Wilmington 98, Del.
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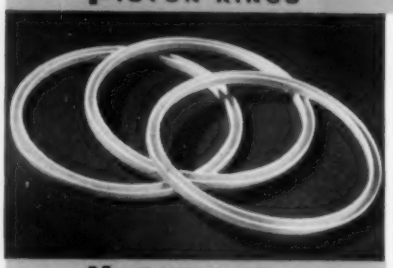
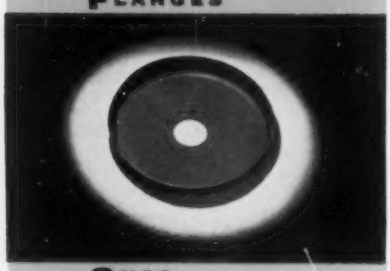
V-RINGS

PISTON RINGS



U-RINGS

FLANGES



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SIGNIFICANT COMPONENTS
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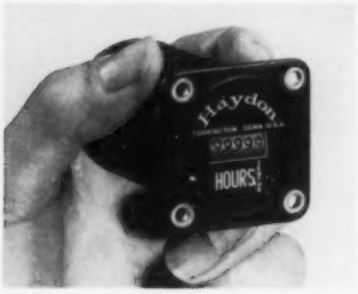
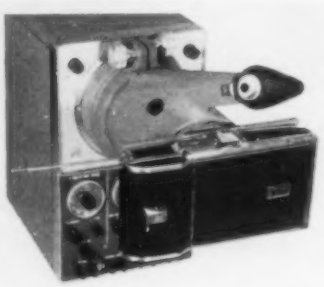


Elapsed-time indicator . . .
has direct-reading, 5-digit counter that records hours and tenths of hours to 9999.9 and then repeats. Said to withstand severe shock and vibration and operate in temperatures from —67 to 159.8 F. Dust-tight case is 1½x2-31/64 in. long. Equipped with synchronous timing motor, for 120 or 240 v ac at 60 cps. Mounts behind or in front of control or instrument panel. Weighs 5 oz. **Haydon Div, General Time Corp, 245 E Elm St, Torrington, Conn.**

Circle 17, Reader Service Card



Oscilloscope-record camera . . .
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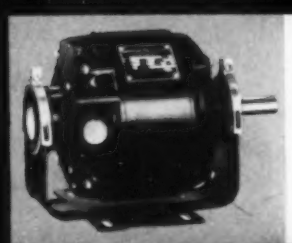

For service that counts, call, wire or write Dept. M-331 today. The Emerson Electric Mfg. Co., St. Louis 21, Mo.

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"WE THREW OUT PRESS FITS FOR BEARINGS...

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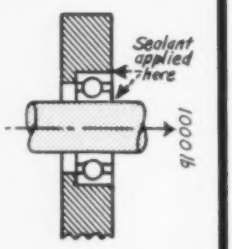
LIQUID SEALANT . . . replaced interference fits and opened up tolerances almost 0.002 in. on shaft and housing for this ball bearing assembly. Load of over 1000 lbs. is needed to break bond.



LOCTITE is a penetrating liquid that hardens only after being confined between closely fitted metal parts. In the absence of air, the sealant hardens into a strong, heat and oil-resistant bond. The hardening action may be accelerated by heating.

LOCTITE eliminates the need for interference fits on bearings, sleeves, shafts and studs . . . locks nuts to bolts, seals pipe and tubing joints. For further information write to:

LOCTITE® SEALANT

AMERICAN SEALANTS COMPANY
119 Woodbine St., Hartford 6, Conn.
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SIGNIFICANT COMPONENTS
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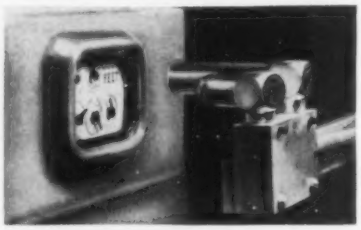

Control of dial accuracy . . . is possible with this sensitive unit, which sets precise thresholds of triggering. In operation, every revolution of a pointer actuates a signal. Said to give accurate registration on a very fine line or dot. Detector was originally developed to test gas-meter accuracy. However, it can be used for weight control because pointer, pre-adjusted, does not pass a specific predetermined point. Unit is provided with a focusing lens for magnification. **ESS Instrument Co, Bergenfield, NJ**

Circle 19, Reader Service Card

Monitors up to 24 units . . . in sequence and indicates an abnormal condition at any point by a red warning light atop control and by an alarm, if desirable. Monitored equipment may also be shut down. Number of affected station is shown in a Burroughs tube. Scanning control protects most measurable variables, with limitation that all stations must have same permissible limits of condition being monitored. Limits, set on a meter relay, may be changed at will. Selector switch checks 12 stations per min, in order. If circuit is interrupted for any reason, load relay drops out and control will not operate. Components are assembled in a NEMA-12 housing. **Assembly Products, Inc, Chesterland, Ohio.**

Circle 20, Reader Service Card

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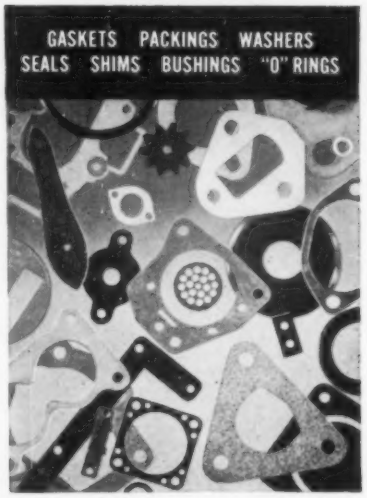

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IRILAC™ #1000

New Clear Protective Coating for All Metals . . . as safe and easy to handle as Water!

New method of protection incorporates corrosion inhibitors in a water-soluble polymer base. Dries to an extremely thin, tough, durable coating—clear in color. Does not chemically affect base metal or any post-treatments. Used as a protective treatment alone or to enhance value of post-treatments.

Allied's new Irilac #1000 is a concentrated solution of a water-soluble polymer with built-in complex corrosion inhibiting materials. It was developed to answer the needs of the metalworking industry for a non-conversion process that will provide corrosion resistance and resistance to fingerprinting and abrasion on base metals and electrochemically or chemically finished surfaces—without changing the appearance of the metallic surface.

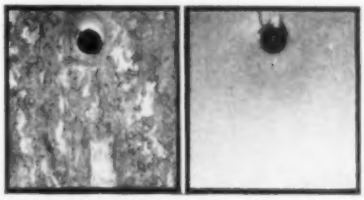
There are no hazards involved—Irilac is non-fuming, non-toxic, and requires no special fire prevention measures.

THE PROCESS

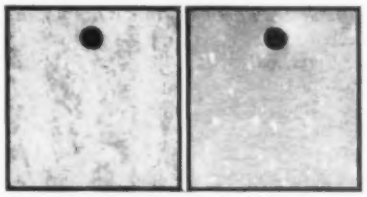
Irilac #1000 is diluted with water to provide a simple one-pass working solution. It is then applied by dip, brush or spray and forms a coating that quickly *bonds* to the metal surface without reacting with the surface.

THE PROPERTIES

The resulting coating is clear, transparent, thin yet durable. It has excellent water-resistant properties, and can be rubbed, handled and subjected to rough treatment. The surface to which Irilac has been applied is not altered—in fact, the transparent coating brings full tone to colored surfaces and clarity to iridescent surfaces. The water-thin physical characteristic of the solution means that the coating provides protection in recessed areas that are difficult, if not impossible, to protect with other methods.



STEEL PANELS: bare (left) and coated with Irilac (right) after 8-hour salt spray.



ALUMINUM PANELS: bare (left) and coated with Irilac (right) after 168-hour salt spray.

WHERE IRILAC CAN BE USED

Irilac #1000 can be applied to *any* metal—wet or dry—treated or untreated. All metals can be processed in *one* operation in the same solution. It can be applied in conjunction with any process—over Iridite, anodized, phosphated surfaces, black oxide, etc. Surfaces treated with Irilac provide a good base for paint.

APPLICATION ADVANTAGES

No other process or material available for the protection of metals offers all the application advantages found in new Irilac #1000:

1. It can be applied to any clean metal simply by dip, brush or spray. No special equipment is required.
2. Saves time—just apply and dry—no reaction time required.
3. No hazards involved—no exhaust or special fire protection equipment is required. Irilac is non-fuming and non-toxic.
4. Saves space. Presents no disposal problem. Low in first and final costs.

Because of its versatility and complete safety, Irilac has unlimited uses. For example, it will protect aluminum furniture, brass hardware and fixtures, steel parts of all types, zinc castings, etc. In fact, any base metal or plated surface, or those treated with electrolytic or chemical post-treatments, can be improved or enhanced with Irilac.

IRILAC #1000 MAY BE THE ANSWER TO YOUR PROTECTION PROBLEM

Our development staff will be glad to work with you to determine the significant benefits Irilac can offer you. Simply send us some parts and let us show you what Irilac can do. No obligation, of course.

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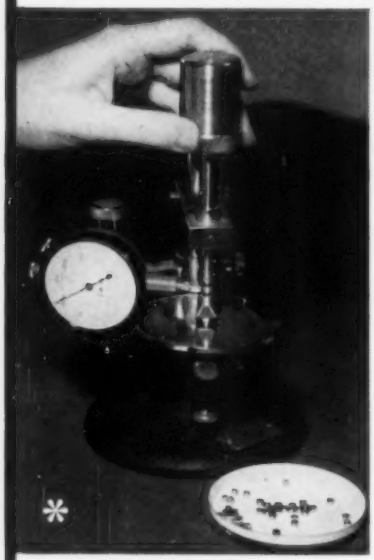

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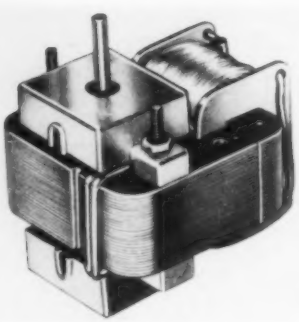

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Circle 22, Reader Service Card

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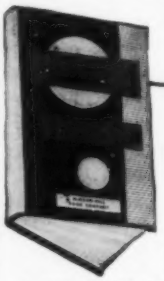

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FAST, HAMMER-DRIVEN RIVET ECONOMICAL FOR BLIND AND OPEN APPLICATIONS

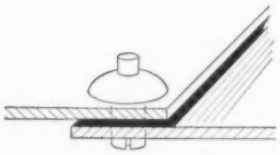

Fig. 1 Inserted in hole, Southco Rivets are quickly set by driving pin with hammer. No special tools are required. Bucking is not necessary.

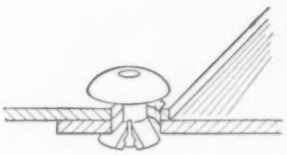

Fig. 2 Expanded prongs force sheets or parts together, hold them tightly in compression. No metal is removed, no grinding or finishing is required.

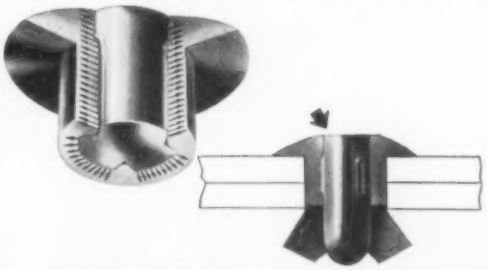

Fig. 3 Pin is locked securely into rivet by displaced metal filling unique grooves. Compression forces are utilized for greater strength.

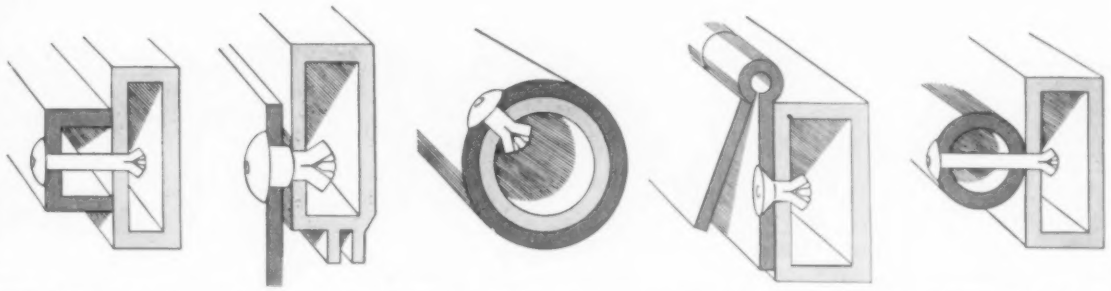

Fig. 4 Ideally suited for "blind" applications, Southco Rivets are worked by one man from one side only and require minimum space inside closed area. They eliminate costly bucking arrangement or time-consuming finishing. Supplied as a unit, they require no job time for assembly or fitting.

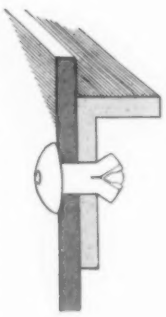

Fig. 5 Access or open fastening utilizes the simplicity, speed and vibration-resistance of Southco Rivets.

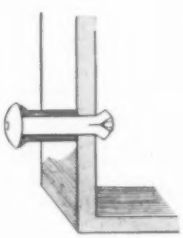

Fig. 6 Ferrules are used as spacers for numerous applications. Here the Southco Rivet forms a drawer pull in conjunction with a flanged tube.

Fig. 7 Increased head size distributes holding pressure over larger area, permits higher loading on wood, plastics and similar materials.

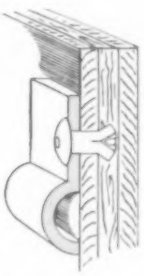

Fig. 8 A blind head can be formed inside the wood. This application is particularly useful when it is desirable to have one surface of the wood unmarred.

FREE

RIVET FOLDER

Send for your free copy of "Southco Drive Rivets" Folder. Gives complete information on the application, installation, and specifications of aluminum and steel Drive Rivets.

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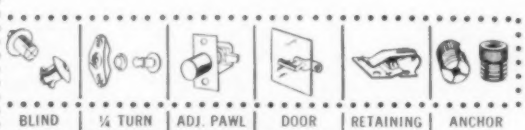

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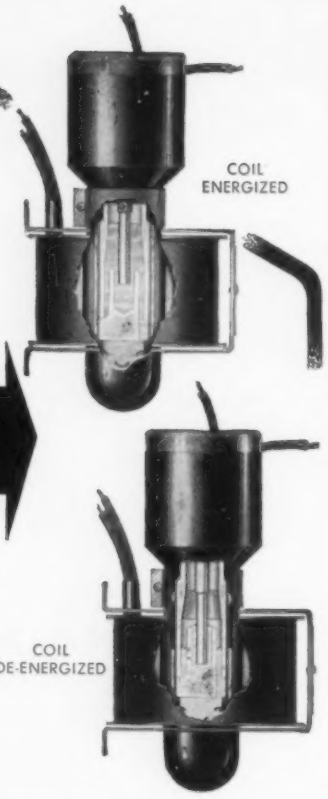

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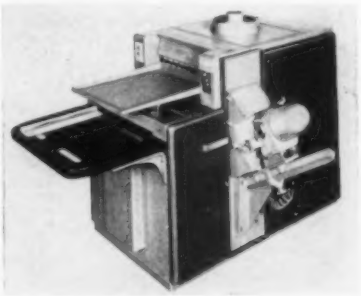

35mm microfilm enlarger . . . produces black-on-white prints that are 14 to 16 times microfilm size. Enlarging and printing are done continuously and finished dry prints, on standard sheets ranging from 8½ x 11 to 18 x 24 in., are delivered in about 4 min. Enlargements are permanent and can be written, drawn and typed on. Machine will accommodate reel, strip or card-mounted microfilm and incorporates a magnifying scanner. Unit works on electrostatic printing principle and uses 19w-cost paper. Occupies 53 x 32-in. floor space. **Chas Bruning Co, Inc, 1800 W Central Rd, Mt Prospect, Ill.**

Circle 24, Reader Service Card

Socket-head cap screw . . . combines new design in thread and body-head fillet areas with increase in bearing area under head. This enlarged bearing surface is said to distribute load uniformly and prevent sapping of tightening force used in preloading. Standard sizes from ¼ to 1 in. Recommended for all applications where indentation of bolted materials is a problem. Many sizes have enlarged sockets to permit greater wrenching area. **Parker-Kalon Div, General American Transportation Corp, Clifton, NJ**

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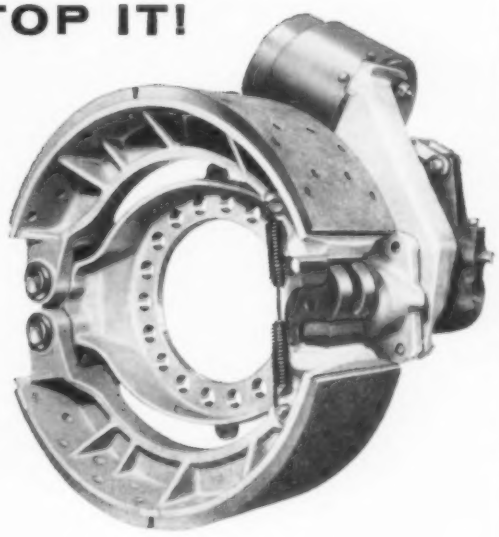

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BRAKE DIVISION Ashtabula, Ohio

ROCKWELL R STANDARD

Space Flight

Carsbie C. Adams, President, National Research and Development Corp. Published by McGraw-Hill Book Co, Inc, 330 W. 42nd St, New York 36. 5⅜ x 8, 392 pp. $6.50.

With the second moon-probe attempt approaching final countdown, manned space travel seems inevitable in the near future. To capitalize on this sudden rush for space, bookstores have been deluged with material relative to man's new adventure. For several centuries "BS" (before Sputnik) all material dealing with space travel was in the realm of science fiction, metaphysics or technical manuscripts found only in scientific journals. With year 2 AS beginning next month, an entirely new kind of scientific literature is being marketed. Physicist and layman alike can enter the same bookshop and find a publication to suit any requirements. So much varied material is now available on celestial travel that only do-it-yourself books remain to be published.

This book, *Space Flight*, is another entry in the field of understanding the hows and whys of space travel. Fortunately the chasm between the technical and the general-interest aspects are well bridged. Although theory and formulas are scattered throughout the book, they may easily be skipped without harm to the basic tenets. Focus is brought on such areas of space travel as astrophysics, communications, geophysics, materials and space medicine. Considerable research went into Dr. Adam's first chapter, "The History of Astronautics," which is one of the finest historical roundups of attitudes and studies towards space travel yet published.

The celestial neophyte may find the vocabularly too "scientific" and will receive no solace when searching for a glossary. However, any intermediate or advanced space-traveler will find the book a valuable addition for the glove compartment of his spaceship. BAL

Research Management

This is a new quarterly magazine addressed to administrators of research activities, whether in industry, government or universities. Published by Industrial Research Institute, the first issue, dated Spring 1958, is devoted to papers presented at past meetings of this 20-year-old organization. Contributions on subjects within the publication's field are welcome. A year's subscription costs $7.50 ($6.50 to IRI members) and may be obtained by writing Industrial Research Institute, 100 Park Ave, New York 17.

GYROSCOPES–Manual, 64 pp. Explains how gyros work. Terms and general operating principles are in a novel, but nonetheless complete, cartoon and line style. Specs for rate gyros, free gyros, directional gyros and compensated vertical gyros are included. Ketay Dept, Norden Div, United Aircraft Corp, Commack, N. Y.

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ENVIRONMENTAL TESTING – Brochure describes system of test procedures and reporting methods for the tests. Procedures are available on subscription basis as a means of insuring compliance with latest MIL specs and testing techniques. System of Procedure Specifications, 11916 W Washington Blvd, Los Angeles 66.

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RESEARCH AND DEVELOPMENT FACILITIES – Brochure, 56 pp. Describes facilities and achievements in basic and applied research and development. Profusely illustrated. Cook Electric Co, 2700 N Southport Ave, Chicago 14.

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FILMS ON PLASTICS–Catalog, 20 pp. Lists some of the motion pictures and film strips available from member companies and SPI. Society of Plastics Industries, 250 Park Ave, New York 17.

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INJECTION PLASTIC MOLDING – Booklet, 4 pp. Illustrates plant and equipment facilities. Makray Mfg. Co, 4400 N Harlem Ave, Chicago 31.

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SOLVING PROBLEMS IN WOOD–Brochure, 28 pp. Describes scope of products, services and research in wood and wood-combined materials and products. Pictorial sections illustrate operations in laboratories and shops, as well as many of the products. Gamble Bros, Inc, 4601 Allmond Ave, Louisville, Ky.

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INDUSTRIAL FELT–Brochure, 12 pp. Tells story of industrial felt. Hard cover holds felt specifications and actual samples. Continental Felt Co, Inc, 22-26 W 15th St, New York 11.

Circle 7, Reader Service Card

INDEX TO ADVERTISERS

This index is published as a convenience to the readers. Every care is taken to make it accurate but PRODUCT ENGINEERING assumes no responsibility for errors or omissions.

Allied Research Products, Inc. 41
Aluminum Co. of America 4
American Cyanamid Co., Plastics & Resins Div. 3
American Sealants Co. 40
Auburn Mfg. Co. 40

Baldwin-Lima-Hamilton Corp., Standard Steel Works Div. 27
Bird Co., Inc., Richard H. 42

Dow Chemical Co. 9
du Pont de Nemours & Co., (Inc.), E. I., Polychemicals Dept. 25
du Pont de Nemours & Co., (Inc.), E. I., Film Dept. 37
du Pont de Nemours & Co., (Inc.), E. I., Polychemicals Dept. 25
Durakool, Inc. 44

Eastman Mfg. Co. 47
Emerson Electric Mfg. Co. 39
Enjay Co., Inc. 18

Fluidwick Co. 48
Halogen Insulator & Seal Corp. 24
Hart Mfg. Co. 26

Link-Belt Co. 6
McGraw-Hill Book Co., Inc. 42

Miniature Precision Bearings, Inc. ... 16
Mirro Aluminum Co. 12–13
Molded Fiber Glass Co 21

Nylok-Detroit Corp. 26

Parker-Hartford Corp. 28
Phillips Chemical Co. ..... 2nd Cover

Rockwell-Standard Corp., Brake Div. 45
Rubatex Div., Great American Industries, Inc. 22

South Chester Corp., Southco Div. ... 43
Split Ballbearing Div. of MPB, Inc. .. 23
Standard Steel Works Div., Baldwin-Lima-Hamilton Corp. 27

U. S. Gasket Co., Subs., Garlock Packing Co. 38
U. S. Graphite Co., Div. of the Wickes Corp. ..... 4th Cover
U. S. Rubber Co., Naugatuck Chemical Div. 15

Warner Electric Brake & Clutch Co. ..... 3rd Cover

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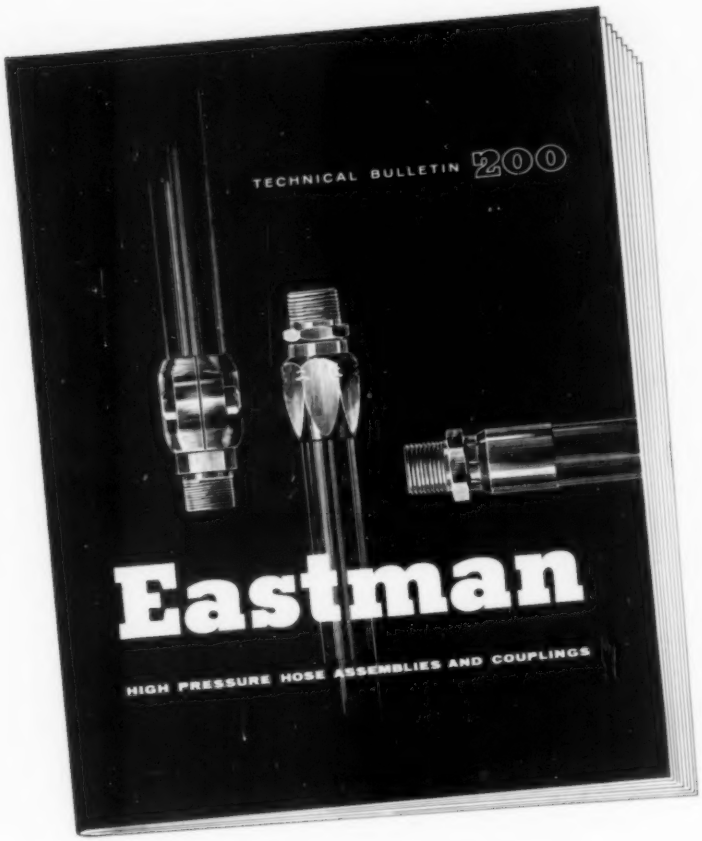

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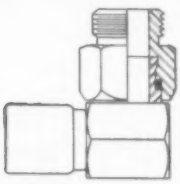
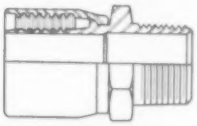
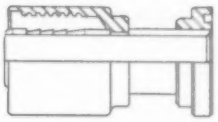
Eastman's new Technical Bulletin offers a new standard in simplified arrangement—for your convenience in specifying—according to your pressure requirements.



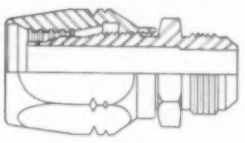
Swivel "O" Ring Male Couplings are available in 45° and 90° angles. Specifications on Page 13.



Permanently Attached Couplings for 2-wire braid hose. Specifications and Details on Page 10.



Permanently Attached Flange Head Couplings and Inserts from 0° to 90°. See complete list on Page 21.



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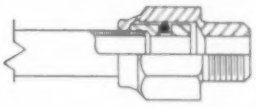
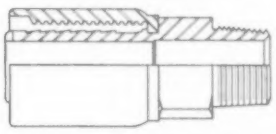


Swivel Male Tube Nut "O" Ring Assembly used on formed tubing—described on Page 30.



Permanently Attached Couplings for **Extreme** High Pressures up to 7000 lbs. working pressure, Page 12.

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Include this new catalog in your files to make it easier to specify the proper assemblies.

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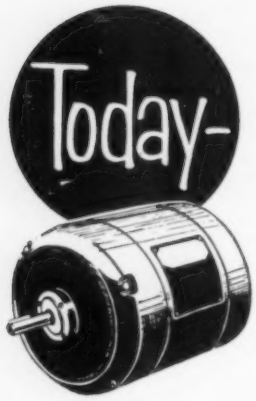

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Publisher's Postscript...

one product – TECHNOLOGY

Many manufacturing organizations, both large and small, have recently invested substantial sums in research and product development facilities. Some enlarged an existing department adjacent to Production; others created completely separate engineering centers away from offices and plants. The separate engineering centers house all product development, research and engineering personnel in one, often elaborate, layout. Included are laboratories, model shops and extensive testing facilities.

Borg-Warner, for example, recently established a product research and development engineering center at Des Plaines, Illinois—well removed from its Chicago headquarters, yet readily accessible to key men in various divisions of the company. The Borg-Warner "Research Center" supplies only one product, technology, to assist the Borg-Warner divisions and subsidiaries in providing the products and processes essential to present and future needs. To appreciate the extent and diversification of the new facilities, you must pay them a visit or leaf through a 28-page illustated booklet describing this operation.

Other companies, such as Yale & Towne, Robertshaw-Fulton, Minneapolis-Honeywell, Thompson Products, American Machine & Foundry, General Dynamics, and all the automotive companies, have established similar engineering centers away from their production facilities, which brings to mind the old argument as to whether a company accomplishes more with such facilities located away from their offices and production plants than if they were closely affiliated.

We don't propose to go into the relative merits of the two methods here, but frequently the establishment of a separate engineering center offers a company unusual promotional and publicity values over and above the practical value of such a center to a company's operations. Many companies have prepared descriptive booklets illustrating such facilities. Many of these have come to our attention. But undoubtedly there are a great many more such booklets or brochures that we haven't seen.

Our editors are intensely interested in receiving such booklets as well as photographs of new engineering facilities, model shops, test stations, etc., that are being developed.

If you have a new booklet or descriptive material concerning an enlarged or newly built research and product development operation, please send a copy of it to Elmer Tangerman, *Product Engineering*'s editor.

Mail them in or bring them in. We like to hear from you.

A.H.

74 For Your Information (personal)

Space Age Hobbyhorse

Ride a cock horse to Banbury Cross, says the old nursery rhyme. But the Space Age child won't be riding Dobbin—not, at least, if Playtime Products, Inc., Warsaw, Ind., has anything to say about it. Its engineers have designed the "hobbyhorse" here. It's complete with a horn that beeps, wheel that steers, gear shift that moves, and a set of rear wheels that click merrily on their way.

There's something new in nursery rhymes too—though Papa will probably enjoy them more than Junior. Frederick Winsor has written a *Space Child's Mother Goose* (published by Simon & Schuster, $3.50) that contains many delightful passages. Sample:

Little Jack Horner
Sits in a corner
Extracting cube roots to infinity.
An assignment for boys
That will minimize noise
And produce a more peaceful vicinity.

New fix-its come in tubes

Two compounds, one an adhesive and the other a heat-removing agent, of types familiar to industrial users, are now making their debut in the consumer market.

The adhesive, a 2-component epoxy-resin system, comes neatly packed in a pair of squeeze tubes, is mixed when needed (photo). Emerson & Cuming, Inc, Canton, Mass., says it cures in 4 hr at room temperature, in a few minutes at 150 F, produces a resilient joint in metals, plastics, paper and ceramics. Retail price of kit is about $1.

The heat-remover is for the radio-TV fan. It's a silicone compound which, its maker says, will "transfer heat away from transistors and thus prevent burnouts." It's designed to replace the grease normally applied between transistors and chassis when the protective coating is removed during servicing. General Cement Mfg. Co, 400 S Wyman St, Rockford, Ill., supplies it in 1-oz tubes. List price is $2.25. Name: Transistor Z5 Silicone Compound.

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WHY DON'T THEY RESEARCH and DEVELOP...

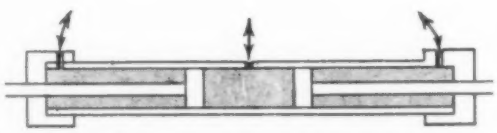
. . . a gasoline additive which, when burned in IC engines would become a fertilizer, lawn food or weed killer. Weekly lawn mowing throughout the summer would automatically treat the grass with downward exhaust from the 2-cycle engines. —G. T. LINK

. . . a dashboard warning-light system to indicate when an auto door is not tightly closed. It could work like the roof light circuit does in many modern cars but the light should go off only when the latch has positively locked. —J. T. MCSHARRY

. . . a self-winding, spring-powered auto clock that is pendulum-wound by the car's motion just as self-winding wrist watches are. It would eliminate wiring, the drain on already overloaded batteries, and be usable on any moving vehicle. —W. HOFFMAN

. . . a fuse that indicates the current flowing through it. Either a temperature-sensitive paint or a simple thermostat, or even a small glowing bulb whose light output increases with current, would be a boon to electricians and home owners. Overloaded circuits and defective appliances could be easily isolated and corrected.

—L. GOLDEN



. . . a 2-piston cylinder offering independent, controlled motion from each of two piston rods. The cylinder would have pistons back to back, and an extra inlet port at the center. Piston rod or cylinder might be fixed to the machine frame to permit extremely versatile speed and location control. —G. HALEVI

Have you a pet subject but neither the time nor inclination to do the necessary R & D? Product Engineering will welcome (and pay $10 each for) similar ideas based on known scientific principles but lacking an inspired manufacturer

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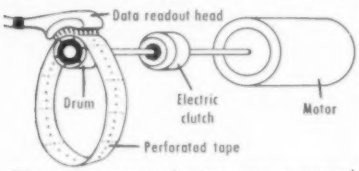
Electric Motion Control IDEAS from Warner

New ways to improve products with electric brakes and clutches

Quick-acting power link for tape-indexing drum

PROBLEM: To index a feed drum one frame of ten lines so a readout head with wire-mesh fingers can detect 80 signals simultaneously from tape perforations. Fingers drop through perforations and contact the silver-plated drum, supplying 60 to 100 bits per step for rapid readout.

Power is from a continuously running motor through a Warner stationary-field electric clutch-coupling. An electronic control unit energizes the clutch field with a 10-millisecond pulse for each 60-deg index. When the clutch is energized, flux flows from the field (stationary-mounted) to the rotor, which is keyed to the drive shaft.



The rotor attracts the armature, mounted on a spline-drive hub to the driven shaft, powering the paper feed drum. Drum rotation never reaches motor speed. Driving occurs in a slipping condition.

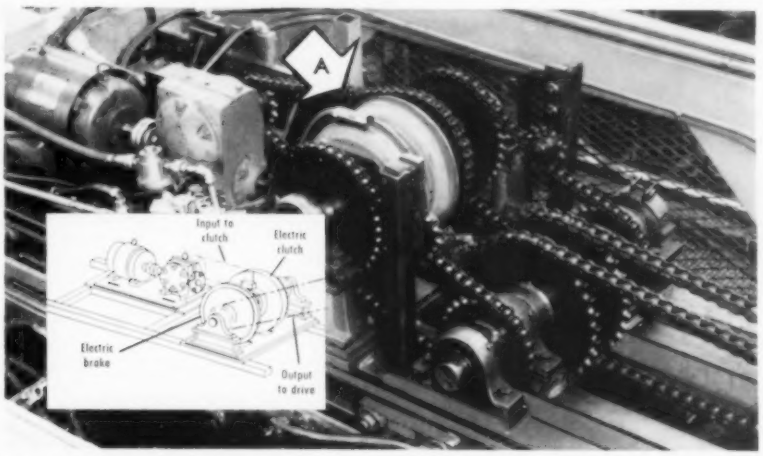
Complete 60° index in 30 ms

The Warner clutch is in the plate circuit of a type 6BG6 tube and is energized for about 10 ms. Parts are accelerated for about 9.5 ms at a torque of about 8 in.-lb. The drum reaches 490 rpm max. for each index.

To build up current in the clutch field, engage the armature and rotor, and start rotation of the drum, requires only .5 ms.

Friction in the clutch is between the rotor and the armature, either of which can be replaced in a few minutes without disturbing the electrical connections. The armature floats axially on a splined hub, providing automatic wear take-up.

Modular Power Drives Uncover Hidden Savings!



Electric clutch-brakes pass automation torture-test

A large automotive plant standardized its power drives for automation equipment, using Warner electric brakes and clutches for actuating motions at duty cycles up to 600 per hr. Purpose was to: (1) reduce peak period air consumption; (2) provide an accurate method of positioning work in automatic machinery; and (3) reduce maintenance costs. Proof of reliability is the fact that *no maintenance* has been required on 150 Warner units used for two years in this plant for applications like the one illustrated above —a straight-through drive, with right-angle jackshaft and clutch-brake (A) to actuate and position a work-elevating device.

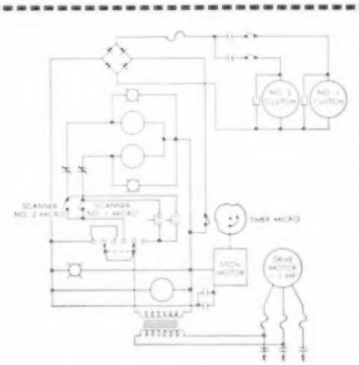
Simplify to save

Fast, precise Warner electric brakes and clutches were not only the control answer for single-revolution cycling of automation equipment, their simple, compact design adapted well to all types of right-angle and straight-through mounting arrangements. They operate at high-duty cycles without heating up—no replacement parts have been required in two years of operation.

Another advantage is speed. Warner units require only 30 watts of d-c to energize the magnets and they release instantly when de-energized. This permits rapid switching from brake to clutch, and vice versa. Complex mechanical linkages and piping are eliminated and the only outside connection required when changing setups at this plant is an electrical plug into the control panel.

Torque adjustment like tuning a radio

Some automation drives require precise actuation, such as when loaders carry steel sheet under the forming dies. Packaged Warner controls (above) permit adjustment of torque build-up so the machinery delivers parts at correct speed for foolproof, automatic production.



Air Scanners Control Clutches

The electrical schematic shows how a printing press manufacturer solved a feed-through problem with two Warner electric clutch-couplings. They operate in opposite directions to drive a tilting bar which makes the running web of the press drift left or right, depending on the direction of tilt. When the roller tilts, the web creeps to the high side. Control is actuated by compressed air aimed at microswitches on either side of the web. In normal operation, the web blocks air to both switches; but, when it drifts, it uncovers a switch to be actuated by the air blast. This starts the drive and centers the web.

Send for more IDEAS

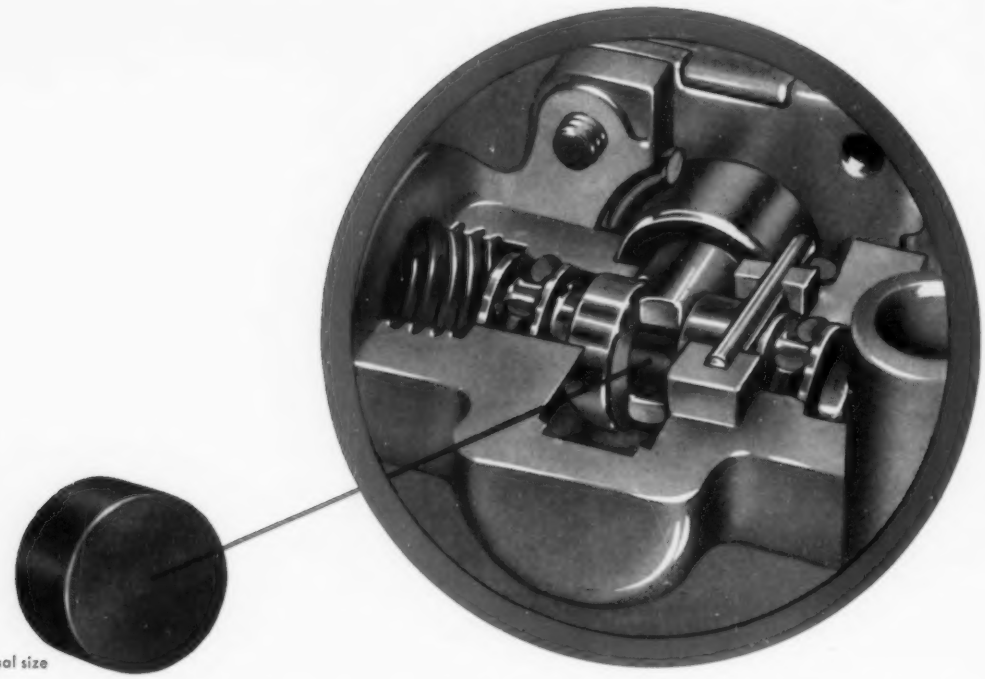
Write for factual application sheets showing how machines can be made more productive, easier to control, simpler to maintain with Warner electric brakes and clutches.

WARNER

INDUSTRIAL PRODUCTS DIVISION

Warner Electric Brake & Clutch Co.

Beloit, Wisconsin



6 times actual size

FOR PRECISION OPERATION

VALCOR solenoid valve relies on a self-lapping GRAPHITAR® disc.

(CARBON-GRAPHITE)

These solenoid valves manufactured by Valcor Engineering Corp. of Kenilworth, New Jersey, incorporate a "floating seal" of GRAPHITAR, and are helping to launch the new age of guided missiles in America. Over half a million Valcor valves are in use in military aircraft and guided missiles today.

The heart of the "floating seal" solenoid valve is a precise, optically flat, GRAPHITAR disc which floats in the plunger. A slight pressure, from either direction, moves the disc against an equally optically flat, stainless steel seat, sealing perfectly. The solenoid valve actually improves with use, due to its unique self-lapping action.

GRAPHITAR has many unusual properties that make it an ideal material for such challenging applications. It is nonmetallic; resists chemical attack; is mechanically strong, yet extremely light in weight. GRAPHITAR will not warp and extreme changes in temperature cause virtually no expansion or contraction. Probably the most important of GRAPHITAR'S advantages are its self-lubricating properties and low coefficient of friction.

Today design engineers are solving many different problems by using GRAPHITAR, a most unusual and versatile engineering material. Perhaps GRAPHITAR is the perfect material for your product. Our competent staff of engineers can assist you in applying GRAPHITAR to your particular needs.

Detailed design data with typical applications, properties and characteristics of GRAPHITAR, are included in Bulletin #20. Write us today—on your letterhead —for a free copy.

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